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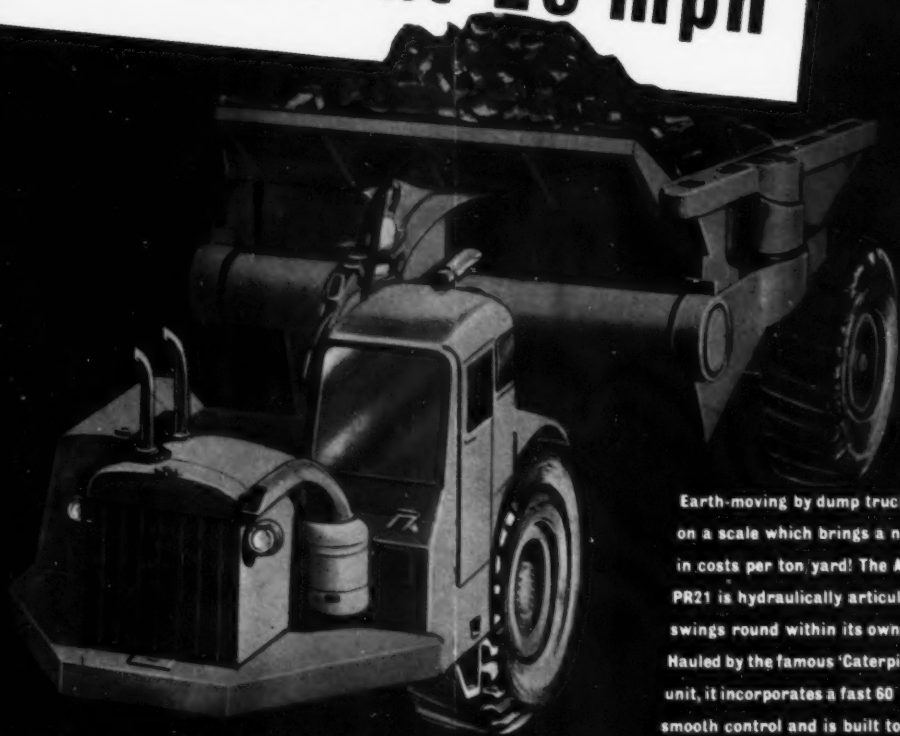
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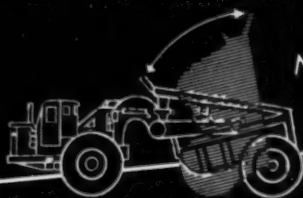
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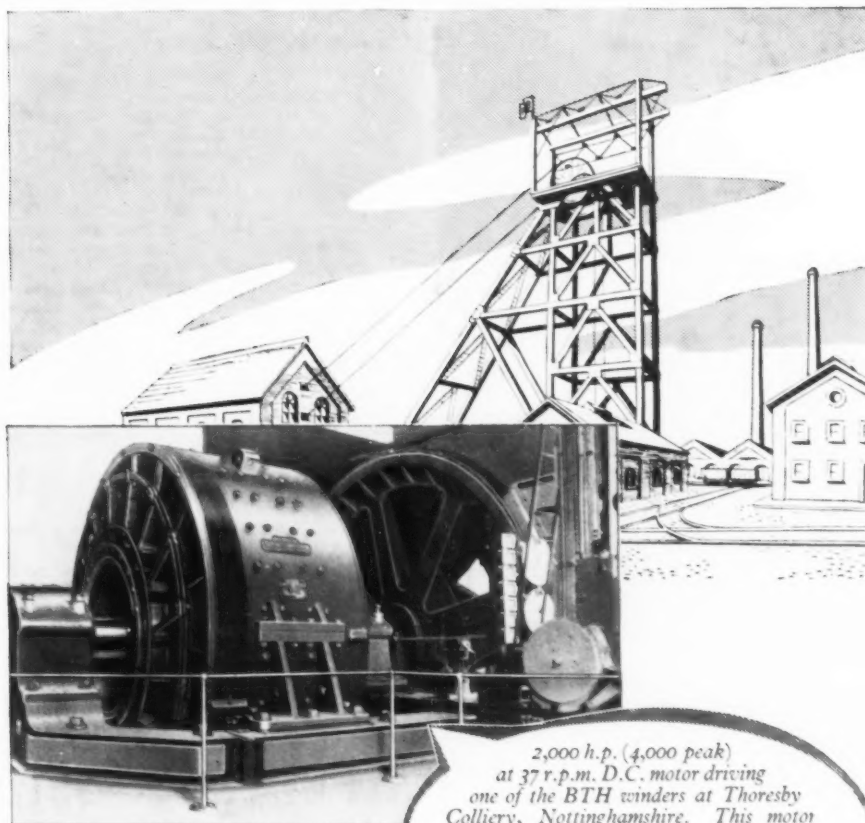
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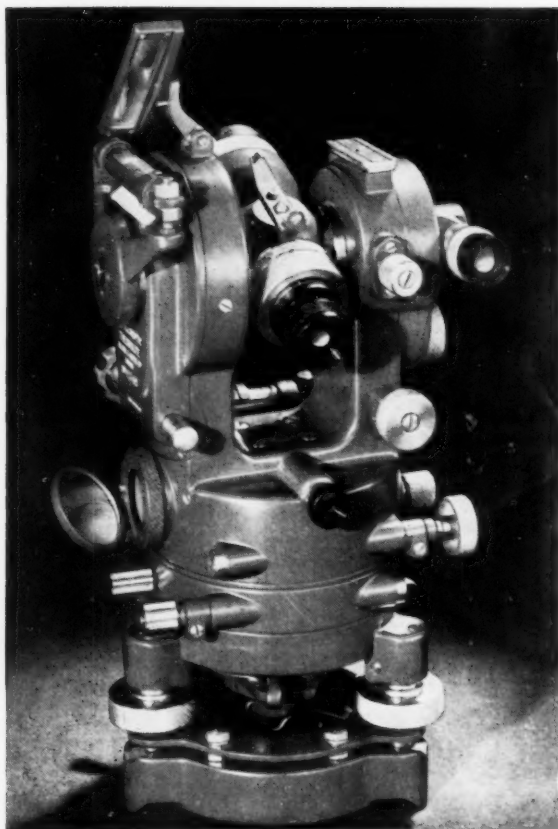
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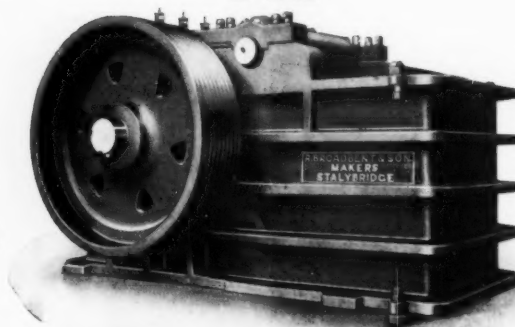
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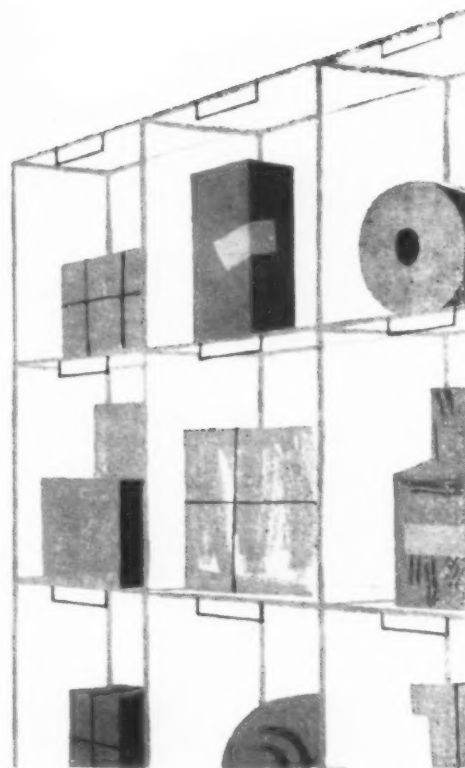
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NOTES AND COMMENTS

The Obverse of Nationalization

The Indian Government has announced its intention of nationalizing the Panna Diamond Mines in Vindhya Pradesh. These are the only diamond mines in India and produce principally industrial diamonds. They yield about Rs.600,000 worth of diamonds annually and the Government hopes to raise this by thirty or forty times during the second five year plan, which began this month. Last June it was announced that Soviet experts would help to develop the Panna mines.

A final decision on the nationalization of the British-owned gold mines in the Kolar field is to be taken at Delhi on April 16. India's Minister of Natural Resources, who will preside over this conference, stated recently that the principle of nationalization of the gold mines had been accepted by all (the Kolar mines have already been nationalized in all but name). The Government proposes to pay "fair compensation," which the Minister defines as the market value of the shares before the idea of nationalization was raised.

Nationalization is in itself unlikely to confer any technical benefits on India's gold and diamond industries. The case for it would appear to be based primarily on the contention that the country's natural resources are the property of its people, who have a prior claim to any profits arising from this exploitation. In principle this view is wholly admirable, but experience in many parts of the world has already shown the fallacy of the assumption that nationalization will allow the people of the country to participate more profitably in the exploitation of mineral resources. In view of the heavy taxation to which mining companies are almost universally subjected, the State has become virtually a sleeping partner in every undertaking, receiving by far the larger share of the profits and, in effect, employing the company as technical managers at no cost to itself.

India's decision to nationalize gold and diamond mining would appear to be particularly short-sighted, coming as it does at a time when the Government is critically dependent on foreign capital for its ambitious programmes of mining and industrial expansion. India will need about

Rs.8,000,000,000 (£600,000,000) in foreign aid during the next five years. Despite the facilities available through such institutions as the World Bank, and the extended credit terms on which equipment for steelworks is being supplied by the U.K., the U.S.S.R. and Western Germany, much of the expansion programme will require to be financed by private capital. For example, a new smelter for the Indian Aluminium Company is being financed through bank loans and \$4,000,000 of convertible unsecured notes, half of which has been subscribed by Aluminium Limited of Montreal. We venture to suggest that Canadian capital might be less readily forthcoming for this project if nationalization of the aluminium industry was at present under consideration.

Bolivia has now apparently had second thoughts on nationalization and is taking the first of three steps that will eventually result in the return of the tin mines to "investor-financed ownership". The intention is to hand over the mines to a company sponsored by both government and private capital, which would evolve eventually into a privately-owned organization. It remains to be seen whether, having regard to the chaotic conditions to which State management is believed to be reducing the mines, the Government will be able to offer sufficient inducement to private investors who in this case are being asked to take over the industry as a whole—the good with the bad.

In Indonesia, the nationalization of the tin industry has appeared to be by no means an unmixed blessing and production is currently running at some 15 per cent below the maximum of which existing installations are believed to be capable. It may well be that countries such as this, which have only come to full self-government in recent years, are placing an unnecessary burden on their machinery of government by committing themselves to the management of a nationalized industry instead of "shedding the load" by continuing to rely on the assistance of responsible private ownership.

Fortunately the delusion that nationalization brings greater prosperity is by no means universally held. In the Gold Coast, the interests of investors are safeguarded against unjust expropriation by a clause in the Constitution—a precedent which has much to commend it. We suggest

that India might with advantage consider the experiences of countries which have already tried nationalization. We in Britain might even have some helpful observations!

U.S. Stockpile Programme

O.D.M. has published its report on the U.S. stockpile programme for the six-month period ending December 31, 1955. One of the salient features is that minimum stockpiling has now been completed in respect of 38 strategic materials. Also noteworthy is an increasing trend towards procurement by exchange of agricultural products.

It is well-known that there are now four separate stockpile programmes: the "minimum stockpile," designed to serve purely strategic and defence requirements; (2) the "long-term stockpile," which is a domestic price-support programme applying primarily to lead and zinc; (3) the "supplementary stockpile," which provides a method of utilizing foreign currencies acquired through the sale of surplus agricultural commodities; and (4) direct barter of U.S. farm surplus for foreign strategic materials for the stockpile. The minimum stockpiling objective covers the period of the next five years, while the long-term objective is designed to discount all foreign sources of strategic materials except for Canada, Mexico and several other Latin American countries.

As of December 31, 1955, stockpile objectives were valued at \$11.2 billion (consisting of minimum objectives at \$6.9 billion plus an additional quantity constituting long-term objectives for metals and minerals valued at \$4.3 billion). On the same date, materials valued at \$6.3 billion were on hand. This valuation represents an increase of \$610,000,000 over the valuation of six months previously.

The total new purchases during the period under review were valued at \$122,700,000. Additional purchases of about \$58,000,000 were based on earlier contracts. During the half-year the Commodity Credit Corporation bartered government-owned agricultural commodities for about \$400,000 worth of strategic materials for transfer towards minimum objectives and about \$16,000,000 worth for long-term objectives. So far, no materials have been purchased for the supplementary stockpile. However, agreements concluded with Brazil and Colombia may result in delivery of as much as \$3,800,000 worth of materials for this stockpile.

Deliveries during the last six months of 1955 included about \$90,000,000 worth of materials stockpiled against the minimum stockpile objectives. The principal materials were cobalt, nickel, metallurgical grade chromite and copper. The remaining \$76,000,000 were applied to the long-term stockpile objectives, the principal materials in this group being tin, aluminium, tungsten, metallurgical manganese, lead and zinc. All the tin came from the Texas smelter, the tungsten from earlier stockpile contracts, and the manganese from inventories acquired under Defence Production Act contracts. The lead and zinc were purchased in accordance with the policy of buying newly-mined domestic production of these metals.

Total deliveries during July-December, 1955, exceeded 600,000 tons. Approximately 23,000,000 tons of strategic materials are now stockpiled.

O.D.M. told Congress recently that purchases for the Federal Government's stockpile of strategic materials in the last six months of 1955 had been lower than anticipated, mostly because of diversions to industry, and were expected to decline further in the months ahead, as forecast by President Eisenhower earlier in the year. Approximately 75 per cent of the total minimum stockpile objectives are now on hand and additional large quantities are on order.

No further appropriations are therefore being sought

from Congress for the fiscal year beginning on July 1. To date a total of \$6,070,000,000 has been expropriated by Congress, of which a balance of \$649,000,000 remains uncommitted. The placing of new contracts is not, however, expected to approach this sum.

Despite diversion to private industry of 9,450 s.tons of nickel up to the end of February, 1956, additions of this metal to the stockpile have been "substantial". An additional 5,000 s.tons of nickel is to be diverted this month for use by industry. In addition, 250 tons of nickel is to be sold to industry from metal produced at the Nicaro plant in Cuba. The total amount released to industry for second quarter consumption will be 10,250 tons. Aluminium is not being stockpiled in the first two quarters of 1956. Various amounts of copper are being diverted from delivery to the stockpile to industry in an effort to relieve tight supplies. Although the mica stockpile has shown some improvement in recent months, there is still difficulty in acquiring acceptable strategic grades in adequate amounts. A research programme looking to the development of synthetic mica or other substitutes has begun.

The UNKRA Mineral Assay Laboratory

A laboratory built and equipped by the United Korean Reconstruction Agency is expected to play an important part in the expansion of Korea's metal mining industry. A staff of two international specialists and six Korean technicians is available to answer enquiries from visitors ranging from part-time amateur prospectors to the heads of leading Korean mining firms. The laboratory is equipped with some of the world's most modern analytical and ore-processing apparatus, such as a heavy media separator, a scintillator for measuring radioactivity, and equipment for spectrographic analysis.

Since its opening in March, 1954, the laboratory has examined more than 5,000 samples to analyse mineral content and value. The statistical listing is a reflection of Korea's widely diversified mineral wealth. It covers 750 samples of gold, 670 of silver and 544 of monazite, as well as samples of iron, graphite, tungsten, fluor spar, talc, copper, asbestos, beryl and many other ores. As part of its analytical work, the laboratory has run 1,164 tests on limestone samples in connection with work on the \$8,540,000 cement plant being built by UNKRA at Mung-yong.

Ore-dressing techniques are worked out for concentrating particular types of ore under the conditions found at individual mines. For instance, the staff is now running lengthy tests to find the most efficient process for the recovery of gold and silver from ore found at the Song Chun mine. The laboratory is also making its modern equipment available to technicians from private companies. Thus the Shiheung graphite mine sent a team to the laboratory to seek better ways of concentrating graphite, which has a high potential export value if the flakes are large and pure. Similarly, the Sangdong tungsten company sent three staff members to use the laboratory's modern Humphrey spiral separator to find out whether the percentage recovery of tungsten could be improved. As another major job, the laboratory checks the value of ore from mines seeking UNKRA loans. When a loan application is filed, a representative of UNKRA's Mining Section investigates the mine's resources and, as part of his work, takes samples to the laboratory for analysis.

In all operations at the laboratory, Korean technicians work side by side with the international staff to become proficient in assaying, chemical analysis and ore-dressing procedures. Under an agreement between UNKRA and the Republic of Korea, responsibility for laboratory operations will be taken over by a Korean director by June 30 of this

year. On the same date control of the laboratory and its equipment will be transferred to the Mining Bureau of the Ministry of Commerce and Industry.

The existence of modern laboratory facilities should be of invaluable assistance to prospectors and miners in many territories where they are still conspicuously absent. UNKRA has allocated a total of \$370,000 for the laboratory in Korea, including construction, equipment, supplies and technical assistance. Rich dividends in national prosperity might be expected from the expenditure of comparable sums on similar projects elsewhere.

Canada

(From Our Own Correspondent)

Sudbury, March 20.

Production from the Sudbury district of Northern Ontario appears to be aiming at new records, including copper, platinum, iron, and more especially nickel. Current output has risen to a rate of close to \$500,000,000 a year. While the value of ore reserves is not officially stated, yet the known tonnage now developed, and the average rate of recovery, has suggested that present ore reserves have a value of approximately \$8,000,000,000.

Lying within a little more than one hour's drive by motor car from Sudbury is the Blind River uranium field where production of uranium oxide is expected to reach a rate of approximately \$100,000,000 annually within the next year. The various new construction programmes now under way in the Blind River field, including the preparations of shafts and ore outlets, is in excess of \$110,000,000.

INCREASING OUTPUT

Estimates of Canada's proven petroleum resources, chiefly in the provinces of Alberta, Saskatchewan, British Columbia and Manitoba, increased by 341,000,000 bbl. during 1955 for a total of 2,756,000,000 bbl. at the beginning of this year, and despite the fact that 130,000,000 bbl. were produced during 1955. In other words, the new petroleum resources proven during 1955 were some 470,000,000 bbl.

Asbestos production exceeded 1,000,000 tons during 1955 with a value of about \$100,000,000. Estimates have been made that a further increase of 50 per cent may be expected over the next ten years. There appears to be no uneasiness regarding continued source of ore supply, in view of the fact that during the past eight years the resources brought to light exceeded 250,000,000 tons of new asbestos reserves. Expenditures on new expansion projects during 1955 amounted to \$40,000,000.

THE CASE AGAINST SECRECY

The Canadian government continues to place restrictions upon the publication of news relating to uranium mining once the individual enterprises have completed their financing—and generally referred to as security regulations. What such measures hope to conceal is a mystery, for the reason that so much is already known about the mines that any ordinary high school boy could quickly figure out the approximate status of individual enterprises. A more objectionable aspect of the so-called security regulation is that it denies the rank and file of stockholders of the producing companies the benefit of news pertaining to new mine developments, yet with the directors and their immediate associates in possession of all the facts. A feeling is growing that secrecy no longer serves any good purpose, and the government would be justified in lifting the veil.

Brazil

(From Our Own Correspondent)

Teresopolis, March 21.

The growing demand and high cruzeiro cost of imports are stimulating asbestos production in Brazil. Output has doubled since 1952 and now averages 2,600 tonnes annually. Imports have dropped from 11,000 to 8,000 tons and imports of manufactured asbestos, which amounted to 1,300 tons yearly, have disappeared from the foreign trade returns.

The Ceara deposits are now being mined, as well as those at Caete, Minas Gerais, and Picoes in Bahia; a recently-discovered occurrence at Sao Domingo da Prata, in the Rio Doce Valley, Minas Gerais, has started production and another is being examined by the Department of Mineral Production (DNPM) near Dois Irmaos, Goias.

Other deposits, proved to date, are: Itaberaba, Conquista and Campo Formoso (Bahia); Lima Duarte, Rocas Novas, Piracicaba, Conceicao de Rio Verde and Tocantins (Minas Gerais); Sant'Ana de Matos, in Rio Grande do Norte; Xilili, near Rio Branco, Pernambuco; and Sao Sepe, in Rio Grande do Sul. The last-named was re-opened in the last war, but closed down when supplies from abroad became available again.

ALUMINIUM PRODUCTION

A German group has applied for licence to install a factory in Espirito Santo, adjoining the Muqui bauxite deposits, to treat the mineral and produce 20,000 tons of aluminium annually.

Reynolds Metals Company, with the approval of the Economy Council, has renewed its application to build an aluminium factory in the lower Sao Francisco Valley, where there are extensive bauxite beds and plentiful supplies of labour and electrical energy. Reynolds plans to process the mineral and produce 100,000 tons of aluminium annually.

A Brazilian associate of Farbenfabriken Bayer, Leverkusen is preparing to produce chromites, bichromites, chromium salts and other products in Rio, using chromium mineral from the Campo Formoso deposits in Bahia.

A Brazilian firm, holding a concession to exploit manganese deposits at Guacui, Espirito Santo, has applied for permission to utilize the hydraulic power of a near-by waterfall. The Company will build a power station and install plant to produce ferromanganese locally. The deposits have measured reserves of 500,000 tons of over 40 per cent manganese and are situated alongside the railway. Tests made in Norway indicate a possible production of 1,500-2,000 tons monthly.

Carborundum S.A., of Sao Paulo, subsidiary of the Carborundum Company of Niagara Falls, is speeding up production and turning out a wide range of abrasives. All raw materials are obtained locally, including aluminium oxide.

Since 1954 DNPM has been trying out a new process for obtaining pure nickel in pilot plant installed at the Liberdade nickel mine, the most important in Brazil. The inventor, Dr. Arykoerner Guerreiro, explains that the process is hydroelectric-metallurgic, based on the "molecular disorder" of the mineral, followed by lixiviation and electrolysis. Only 6,000 kWh. and 550 man/hours are needed to produce one tonne of pure metal. Costly electrodes and raw materials, high-grade refractory materials and delicate apparatus are not required. Local production of pure nickel is about 220 tons annually for an apparent consumption of 1,100.

Aluminium in the Motor-car Industry

Based on a recent survey by Alcoa, this article reviews the remarkable headway made by aluminium in the U.S. motor car industry. The accompanying table, for which we are indebted to the Aluminium Development Association, indicates that aluminium is being still more extensively used by British and Continental manufacturers.

An impressive indication of the expanding usage of aluminium in the U.S. motor car industry is given by a recent survey, carried out by Alcoa, in which applications and quantities are analyzed by make and model of car. Based on an estimated output of 7,000,000 vehicles by U.S. manufacturers in 1956—a figure which, despite the latest cuts, still seems to be generally accepted—Alcoa forecasts that a minimum of 123,000 tons of aluminium will be required. This represents an increase of 18 per cent over the previous year and any marked increase in the trend towards automatic transmissions will tend to be accompanied by a further rise in the requirements of aluminium.

The survey, which revealed that the average 1956 American car uses 35.2 lb. of aluminium, also indicates that 49.8 lb. per unit will be required by 1960, rising to 81 lb. by 1965. Mr. Harry L. Smith, Jr., vice-president in charge of Alcoa sales development and market research, has stated that, if aluminium were to be applied to all uses now practicable or feasible, the total requirement per car would exceed 300 lb. Present consumption ranges from 9.26 lb. used in the standard Studebaker Champion Six up to 191.5 lb. required in the production El Dorado model of Cadillac with its aluminium grille and sabre spoke wheels. Less than a decade ago the average consumption of aluminium per U.S. car was less than 10 lb.

The high strength/weight ratio of aluminium becomes particularly attractive when the manufacturer's aim is to restrict the capacity of the engine and achieve optimum performance with maximum fuel economy.

It is interesting to compare the foregoing figures with the aluminium content of British and Continental cars given in the table. From the examples given it may be concluded that, except in the smaller models, British manufacturers are using substantially more aluminium per car than goes into the average American automobile, despite the very much smaller dimensions of an average-sized British car. It will be seen that the XK120 Jaguar contains no fewer than 182.25 lb. of aluminium. The light metal would appear to be still more extensively used in Continental models; in fact, the Lancia Appia's consumption of 297.0 lb. per car is little below the total potential usage foreseen by Mr. Smith.

The requirements for passenger cars alone are expected

to amount to about 6 per cent of the total aluminium output in the U.S. this year, including both primary and secondary metal. An additional 7,000 tons of aluminium ingot will be required to deoxidize the steel consumed in car manufacture, while yet another 17,500 tons will be required for the production of replacement parts during the life of the car. Other types of transportation equipment will consume a further 10.6 per cent of aluminium supply, or an estimated 173,000 tons.

The Alcoa survey shows that nearly 50 per cent of the aluminium in passenger cars goes into automatic transmissions. Another major application of the metal is in the engine, now using 30 per cent of the total. Body trim accounts for a further 7 per cent and offers one of the most promising applications for future growth. The remainder of the aluminium consumed goes into miscellaneous applications such as wiring, brakes, power steering and air conditioning units.

Several reasons are given for the increasing usage of aluminium in the U.S. motor industry. Among them is the trend towards V-8 engines, which require more of the light metal than six-cylinder units.

Another important factor has been the General Motors change in automatic transmission design, which has called for an additional 14 lb. of aluminium per unit. Much of the increased consumption is in the form of aluminium exterior trim, some of it being in colour. At least three cars used gold finished aluminium for exterior decoration. Cadillac and DeSoto use aluminium grilles, while the Hudson displays side panels of gold aluminium sheet. Cadillacs are obtainable with golden grille and sabre spoke wheels.

Demand has been stimulated by the progress of diecasting, which is to-day the principal method for producing aluminium motor car parts. The new 1956 models of U.S. cars average 15.7 lb. of aluminium die castings per car as compared to 12.3 lb. in the 1955 versions.

It is predicted that the next important advance for aluminium in motor cars will be in the production of radiator fins joined to brass tubing. Eventually, motor car radiators may well be all-aluminium. It was further stated that engine blocks and heads, brake drums and bearings, and differential housings are wide-open fields.

Alcoa's forecast that manufacturers in the U.S. will produce 7,000,000 cars in 1956 was made after comparing estimates by producers, business and trade publications, inde-

ALUMINIUM CONTENT OF EUROPEAN MOTOR CARS
(On Basis of Weight)

Make	Model	Cylinders	C.C.	Aluminium Content	Dry Weight	Aluminium Dry Weight %
				lb.	lb.	%
BRITISH						
Austin	A30 - 2 door	4	800	42	1456 (13 cwt.)	2.88
	A30 - 4 door	4	800	42	1484 (13½ cwt.)	2.83
	A40	4	1,200	44	2248 (20 cwt.)	1.95
	A50	4	1,500	44	2258 (20½ cwt.)	1.95
	A90	6	2,639	55.5	2912 (26 cwt.)	1.90
Morris	Minor - 2 door	4	800	22.75	1600 (14½ cwt.)	1.42
	Minor - 4 door	4	800	22.75	1632 (14¾ cwt.)	1.39
	Cowley	4	1,200	40.25	2264 (20½ cwt.)	1.78
	Oxford	4	1,500	40.25	2335 (20¾ cwt.)	1.72
	Isis	6	2,639	54.25	2850 (25½ cwt.)	1.90
Wolseley	4/44	4	1,250	33.5	2431 (21½ cwt.)	1.38
	6/90	6	2,639	45.75	3239 (29 cwt.)	1.41
M.G.	Magnette	4	1,500	41.5	2404 (21½ cwt.)	1.72
Riley	Pathfinder	4	2,443	53.25	3333 (29¾ cwt.)	1.61
Jaguar	XK120	6		182.25	2770 (24½ cwt.)	6.58
ITALIAN						
Fiat	600			52.58	1288 (11½ cwt.)	4.08
	1100			83.60	1904 (17 cwt.)	4.40
	1400			101.20	2408 (21½ cwt.)	4.20
	1900			118.36	2530 (22½ cwt.)	4.68
Lancia	Appia			297.0	1792 (16 cwt.)	16.50
FRENCH						
Renault	750			37.25	1232 (11 cwt.)	3.03
Renault	Fregate			58.19	2800 (25 cwt.)	2.08

Mercedes Type 180M Engine has 72½ lb. of aluminium. Engine weighs 190.8 lb. Aluminium content — 38 per cent of engine weight.

pendent economists, and the company's own automotive experts. Its confident outlook is shared by the motor car manufacturers, who see no reason to anticipate any critical recession in the industry, despite the temporary saturation of markets which is resulting in production cuts.

At the opening of his firm's annual motor show in New York, Mr. Harlow Curtice, president of General Motors, predicted that 1956 would be the second best year in the corporation's history. He estimated that the U.S. domestic market would absorb 7,500,000 new cars and lorries. The total U.S. output in 1955 was approximately 8,000,000 cars and 1,250,000 lorries. With Canadian assemblies, the total came to nearly 9,750,000 units. Mr. Curtice ascribes last year's astonishing figures as "due to an extraordinary and unprecedented bulge" in demand. In view of the "favourable economic climate", he believes that full employment will continue and that 1956 will witness the continued upward trend of construction, highway expenditure, and capital expenditures by industry.

The confidence felt by General Motors in the long-term future was convincingly demonstrated by the decision to accelerate the corporation's programme of capital expenditure for the current year to provide the record outlay of \$1,000,000,000. In the U.K., leading motor car manufacturers have announced their intention of proceeding with expansion programmes aggregating many millions of

pounds. Germany, too, is planning for a big increase in car production. Far from being discouraged by any disquieting factors in the short-term outlook, the motor industry in Britain and Western Europe is preparing vigorously for further expansion in which aluminium must surely share.

Aluminium's growing importance to the motor car industry is underlined by a contract recently concluded between Ford and Reynolds for the largest quantity of this metal ever involved in an industrial order. Under the agreement, Reynolds will deliver to Ford during the next ten years an amount of primary aluminium expected to exceed 320,000 tons. The contract will be renewable at the option of Ford. It is planned to deliver most of the aluminium in molten form direct from a new \$80,000,000 reduction plant to a Ford foundry which will be built beside it. This new unit will be Reynold's seventh reduction plant and will add 100,000 tons to the company's annual capacity of primary aluminium, increasing it to over 550,000 tons a year.

In announcing this project Mr. R. S. Reynolds, Jnr., president of Reynolds, said that Ford's requirements would take less than a third of the additional output, leaving a balance available for other fabrication, which would help to ease the present shortage of primary aluminium. He described the new plant as part of a current cycle of expansion in the industry, which "reflects confidence in the continued growth of aluminium markets".

KOEPE SYSTEM IN SOUTH AFRICAN GOLD MINES—IV.

Output of Koepe Hoists

The following article discusses the output potentials of the Koepe hoisting system in relation to the drum winder hoisting gear and is the fourth of a series discussing the efficiency of the Koepe system in the gold mines of the Witwatersrand and Orange Free State. The article is condensed from a paper presented at the monthly general meeting of the South African Institution of Mechanical Engineers on January 12, 1956, by L. T. Campbell Pitt, O.B.E., M.I.Mech.E., a Past President of the Institution, and F. G. Zeppenfeld and A. W. P. Hallett, M.A.(Cantab.), M.I.Mech.E., members. Subsequent articles will consider the power requirements of the system and rope attachments for multi-rope hoisting installations.

In consideration of the output of a Koepe hoist and the comparison of this output with that of a conventional drum winder, reference to the graph below shows the rope factors for various conditions and hoisting depths as governed by Regulation 37 (11).

A. shows the factor for a rope at discard, its breaking load having been reduced by ten per cent. The end load is one-ninth of the reduced breaking load which, added to the weight of 5,600 ft. of suspended rope, gives a factor of safety of 4.5 at that depth. These factors of nine and 4.5 are the minima allowed under the Regulation.

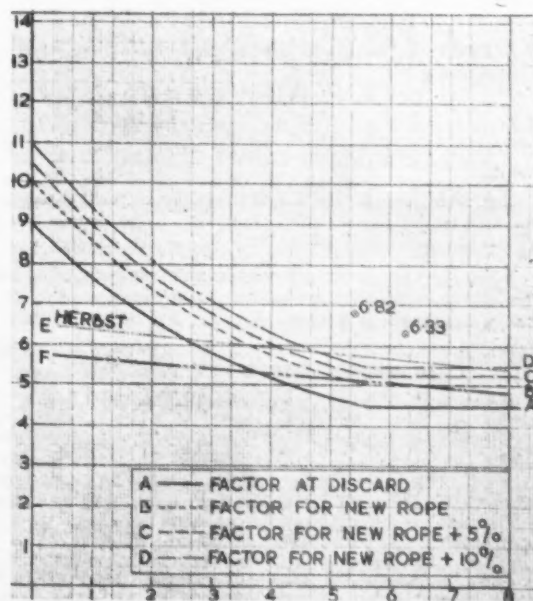
B. shows the factor expressing the relationship between the breaking load of a new rope and the combined weight of the suspended length of rope and the end load (determined by A.) attached to it. In other words, the safety factor of a new rope at varying depths.

C. shows these safety factors increased by five per cent as suggested for a two-rope Koepe hoist. D. shows the factors increased by ten per cent as suggested for a four-rope Koepe hoist. E. shows the safety factor for a new rope calculated from Dr. Herbst's formula but related to the breaking load of the rope instead of the aggregate of the breaking load of the individual wires. F. shows the corresponding discard factor allowing a ten per cent reduction in breaking load.

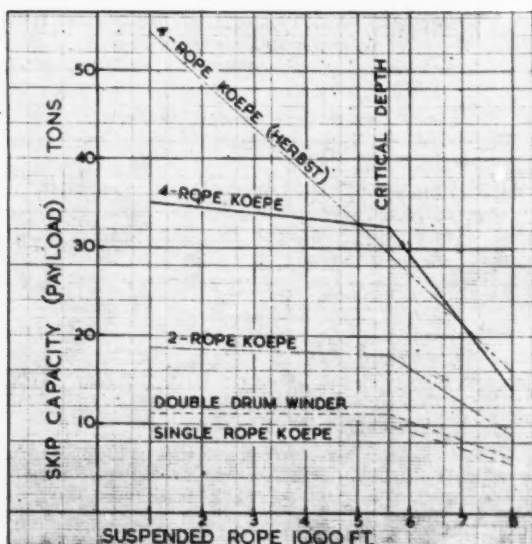
From these curves of safety factor, the rope end load and the skip capacity or payload may be determined for any length of suspended rope. They have been plotted in the graph on the next page.

This graph has been calculated for the following conditions, where applicable. Two inch dia. ropes weighing 7.07 lb. per ft. and having a breaking load of 197.8 s.tons.

corresponding to 128/140 ton steel; loads in accordance with the safety factors laid down by Regulation, or suggested for application to the Koepe hoisting system.



Factors of rope safety. Vertical numerals denote rope safety factor; horizontal numerals denote suspended rope 1,000 ft.



Skip capacity (payload) for hoists using 2 in. dia. rope

Payload = .57 × end load for drum winder, or
.50 × end load for Koepe hoist.

The suspended length of rope (for calculation of payload) for a Koepe hoist is 160 ft. greater than the hoisting distance and for a drum winder 50 ft. greater than the hoisting distance; acceleration and retardation = 3 ft. per sec. per sec.; maximum rope speed = 3,000 ft. per min.; automatic winding cycle with an allowance of 1½ sec. for loading.

Hoisting time of eight hours per day and 25 days per month; Ward-Leonard controlled D.C. electrical drive; only rock hoisting has been included; calculations have been carried beyond the normally expected limits of hoisting depths in order to show trends; rope tread pressure not more than 210 lb. p.s.i., and tons of 2,000 lb. have been used throughout.

COMPARISON OF PAYLOADS

Referring to the graph above, it is interesting to note the following:

For a drum winder and for a single rope Koepe the payload is constant down to the critical depth, thereafter it diminishes in accordance with the safety factor requirements.

For multi rope Koepe hoists the payloads (and therefore the end loads) show a slight reduction with deeper shafts as far as the critical depth.

From the information already given, it can be shown that the end load which may be attached to a rope at x feet below the sheave is given by:

End load = .0909 B - .091 Wx for a four-rope Koepe,
or .09523 B - .0477 Wx for a two-rope Koepe.

Below the critical depth the payloads rapidly decrease.

The great increase in payload afforded by the multi rope Koepe hoist. For a hoisting distance of 5,000 ft. (suspended rope = 5,160 ft.) the payload hoisted by a two-rope Koepe is 1.6 times and for a four-rope Koepe 2.88 times the payload hoisted by a drum winder with the same size of rope.

The close approximation to the suggested loads which is given by the Herbst formula below 5,000 ft., but the wide divergence at shallower depths.

Assuming an automatic winding cycle for eight hours

daily and 25 days per month with a maximum winding speed of 3,000 ft. per min., these skip capacities may be translated into tons hoisted per month.

A SIGNIFICANT FEATURE

The curves of monthly output present the following points of interest.

The greatly increased output afforded by the multi-rope Koepe hoist when compared with that of a drum winder. This is shown graphically in the graph below, in which the drum winder is shown as unity. Expressed in other words, one four-rope Koepe hoist could be used instead of three drum winders at depths of 5,000 ft. or less. This is, perhaps, the most significant feature of the Koepe system.

For depths less than the critical depth, the output shows a reduction with increasing depth due solely to the increasing time of the hoisting cycle.

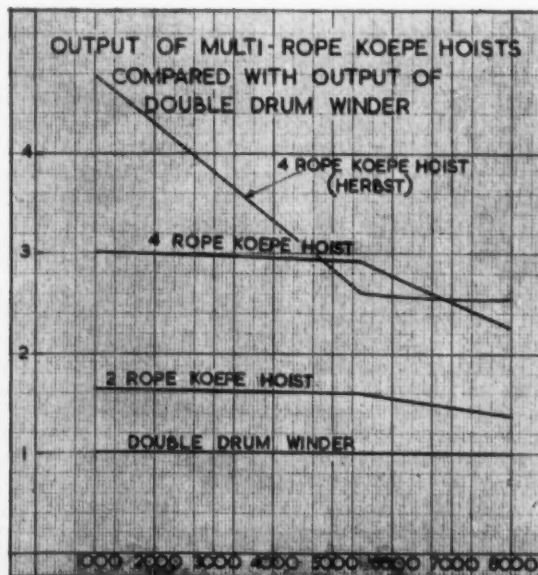
For depths greater than the critical depth the output shows a double reduction due to (a) the longer hoisting cycle, and to (b) the diminished payload required by the factor of safety.

CONSIDERATIONS OF LIMITATIONS ON SHAFT HOISTING DEPTH

Here may lie the reason for imposing a limit on the hoisting depth of a particular shaft when maximum tonnage is being considered.

For depths below the critical depth, it is evident that output falls off rapidly and that consideration must be given to hoisting in two stages. The tonnage which will be required to be hoisted in the ultimate years of a sub shaft, together with the tonnage required to be hoisted from the workings connected with the main shaft, would form a basis for the determination of the relative hoisting depths of the main and the sub shaft.

Considering no other factor than that of ultimate output, it appears to be more advantageous to keep both shafts within the limit of the critical depth. Many other factors have to be considered, however, but these fall outside the scope of this paper.



In this graph showing output of multi-rope Koepe hoists compared with output of double drum winder, horizontal numerals denote hoisting depth in ft.

COAL RESEARCH—I

Research on Coal Mining Problems

This is the first of two articles reviewing some of the work in progress at the Mining Research Establishment of the National Coal Board at Worton Hall, Isleworth. This article is devoted to environmental research and the development of instruments for the measurement and recording of dust and gas. The Establishment's work on rock drilling problems, strata control and auto-percussive ploughs will be reviewed in a subsequent issue.

In 1951 it was realized by the National Coal Board that the existing resources at the Central Research Establishment, Stoke Orchard, near Cheltenham, were insufficient for its future research requirements, and that a second establishment was needed in which mining research could be concentrated, leaving the Stoke Orchard establishment free to deal with coal preparation and associated problems. In January, 1952, the search for a suitable site was begun, but a month later the Board decided to look for premises suitable for conversion instead of erecting new buildings on a vacant site. Among several properties inspected were the Isleworth Studios, Worton Hall, formerly the British Lion Film Corporation.

This property appeared peculiarly attractive, apart from its proximity to the existing Headquarters of the National Coal Board in London. In the five acres were 50,000 sq. ft. of floor area in existing buildings, with some further thousands of sq. ft. ready concreted as and when further building extensions should come to be required. The decision to begin negotiations for the acquisition of the property was made in March, 1952, and the contract between the National Coal Board and the British Lion Film Corporation was signed in May. The Film Company vacated the premises on June 30, and on the next day the Acting Director of C.R.E. II established his office in the Manor House.

Since that time development as a research establishment has been rapid. Extensive conversion of the existing buildings has been undertaken, and a large scientific staff has been built up around a nucleus of scientists transferred from Stoke Orchard. The Hall itself, however (officially Worton Hall, but generally known with the establishment as the Manor House), has seen only superficial change. Structurally it is essentially the same building as that erected about 1790 to serve an entirely different purpose.

Dr. Leonard Charles Tyte, C.B.E., was appointed Director of the Mining Research Establishment in April, 1955. He is responsible to the Director General of Research, Dr. W. Idris Jones, at headquarters.

The establishment is not yet fully staffed, but research programmes are gradually evolving and the Mining Research Establishment is already making its contribution to the solution of important mining problems, many of which are by no means confined to the coal industry.

ENVIRONMENTAL RESEARCH

Problems associated with environmental conditions play an important part in the research programme at Isleworth. The dangers of dust and gas, two of the subjects under investigation, are well known. Attention is also being given to problems of temperature and humidity, which will become of major importance as deeper coals are exploited.

Improved instruments have been devised for measuring the amount of dust in the air. These collect only dust which is fine enough to enter the lungs and they do this continuously over a working shift. These features greatly simplify the problem of surveying dustiness.

Studies are being made of the mechanisms of dust formation and techniques of dust suppression. In mining pro-

cesses it is desirable, firstly to reduce the formation of fine dust as much as possible, and secondly to prevent any that is formed becoming airborne.

In rotary drilling for example, it has been found that the proportion of fine dust formed is related to the penetration per revolution of the drill, falling off quite rapidly as this is increased until a certain penetration per revolution is reached, after which dust production remains approximately constant. Scroll type rotary drills tend to produce more fine dust than do other rotary drill types where debris is moved down straight channels away from the drill bit.

THE DUST AND GAS HAZARDS

For some time it has been appreciated that water sprays are effective in reducing airborne dust concentrations underground. This appears to be due to the wetting of dust on the ground, thus preventing it becoming airborne, rather than to the removal of airborne dust by impact with falling drops. Research has shown that for very fine dust, airborne capture under normal coal mine conditions is almost negligible.

The examination of the effectiveness of water, wetting agent solutions and other materials such as hygroscopic salt solutions for the "dust proofing" of various coals, is in progress. A standard test has been developed, in which about 6 lb. (1,500 gm.) of coal is dropped 9 ft. in an enclosure from which the air is exhausted along a horizontal duct. Fall out of particles along the duct is measured, and all the remaining airborne dust finer than about 20 microns is measured after collection on filter paper.

Some rather interesting results are being obtained in this work. For example: if the coal is treated by spraying with a wetting agent solution and is then dropped immediately without any mechanical disturbance, far less airborne dust is dispersed than when the coal is treated with same quantity of water. On the other hand, if a certain amount of mechanical "mixing" of the coal takes place after treatment, better spreading of liquid over the surface of the coal occurs and less dust is dispersed both with the water and wetting agent solution and furthermore, the water and wetting agent solutions are now approximately equally effective in reducing dust dispersion. It appears likely that in normal mining processes enough mechanical mixing takes place to cancel out any possible gain from the use of wetting agent solutions in place of water. A certain amount of confirmation has been obtained in underground tests.

Ignitions of methane leading to fires or explosions of methane itself or of coal dust clouds constitute another immediate danger to life. N.C.B. research on methane has so far been concerned with providing better measuring instruments, particularly ones capable of continuous operation, both to give a recording of the gas concentration and to provide an automatic warning of a dangerous concentration.

One type of instrument, of which the development is well advanced, measures the rate of combustion of methane in a small, specially controlled "Calor Gas" flame. One version of the instrument will be a recorder to operate for a week without refuelling and the other a portable alarm to operate for one shift. The recorder will consist of (1)

a unit somewhat similar to a flame safety lamp and including gas regulating equipment at the base and thermocouples above the flame and (2) a recording milliammeter giving the output from the thermocouples and calibrated 0 to 3 per cent methane on a 3 in. scale.

Also under development is a variation of the recording flame methanometer, which works on the principle of having a small sensitive bi-metal alarm actuated by an increase in the flame temperature as it burns a methane-air mixture.

Another type of instrument, still in an experimental stage, measures methane in terms of its infra-red absorption and is being planned for long-term stability so that it can be left for long periods underground continuously monitoring the gas concentration. Detailed laboratory tests have been carried out on small portable interferometers designed for methane measurement in mines, namely Riken, Toka, Shinko and Zeiss methanometers. Measurements to about 0.1 per cent methane have been shown to be possible and the usefulness of this type of instrument underground is being investigated by pit trials.

HEAT AND HUMIDITY

Deep mines, which will be more numerous and even deeper in the future, are naturally hot and sometimes humid. It is necessary to know how heat reaches and is taken up in working places, so that means may be devised of ameliorating bad conditions in existing mines and that new pits can be planned to minimize the effects of high strata temperatures. Experiments have been made at Llay Main Colliery as a check on theoretical means of predicting the flow of heat into mine airways and the experience gained there has led to the formulation of a programme of work on laboratory models of mine workings in which thermal effects can be studied more readily and quickly than underground. Apparatus has been devised for determining the temperature of undisturbed strata via boreholes prior to sinkings being made.

New tunnels being driven into undisturbed strata are particularly difficult from the thermal point of view owing to the lack of through currents of cooling air. Studies have been made of the behaviour of a local refrigerating unit providing conditioned air in a heading at Snowdown Colliery. Reheating of the cooled air during passage to the working face in a duct has been shown to be largely due to heat radiated from the walls of the heading and the importance of careful distribution of the conditioned air at the face has been demonstrated.

DEVELOPMENT OF INSTRUMENTS

Many of the instruments required for the investigation and control of environmental conditions are being developed at Isleworth, where extremely well-equipped workshops have been provided.

The Dust Sampler, type 101, is intended to be used in large numbers underground as a "control" instrument. It will be left in the return airway, coal face, or other working place, to collect a dust sample covering a whole working shift (up to eight hours' duration). Dust laden air is drawn, by a small clockwork driven breathing pump, through the sampling head; 2 ml. of air being inhaled in one half minute and exhaled in the following half minute. The non-respirable fraction of the dust is first removed by passage of their airborne cloud through a horizontal elutriator (artificial nose), whilst the remaining dust is collected on a microscope slide, or cover slip, by a combination of gravity settlement, and thermal precipitation. Current for the precipitator wire is from a Miner's hand lamp type battery.

Another instrument, the Dust-Sampler type 102, is intended for use by Dust Suppression Investigators after the

concentration at a working place, as measured by the long running instrument, has been found to be greater than the maximum allowed by the regulations. Dust is again collected by a process of thermal precipitation, and an artificial nose is also incorporated, so that only the fraction trapped in the lungs is collected on the slide. Up to ten samples may be collected on a microscope slide, or eight on a cover slip, without having to reload the instrument. The air is drawn through the sampling head by a pump comprising a metal bellows controlled by a clockwork escapement. The pumping action can be preset so that either 25 ml. is drawn through in five minutes, or 50 ml. in ten minutes.

The conventional type of remote control pilot circuit employs a technique for the prevention of inadvertent starting of a control machine which is considered to be unsafe, since the protection becomes ineffective when the supply voltage rises above a certain limit. With circuits designed to comply with a recently issued Production Department Specification, this limit is not far removed from the normal working voltage of the circuit, so that it may become dangerous. A number of experimental circuits have been designed at M.R.E. which effectively prevent inadvertent starting, no matter how high the supply voltage rises.

APPLICATIONS OF TRANSISTOR TECHNIQUES

Equipment using conventional electronic valves cannot be taken underground unless it is mounted in an approved flameproof enclosure. This means that amplifiers, oscillators and other electronic circuits cannot be used in pit investigations because of the impossibility of handling large flameproof boxes in roadways and faces, etc. One way to overcome this difficulty is to use transistors which operate on a much lower voltage than valves, do not have any incandescent filaments, and consume considerably less power. As an example of the work being done by the Establishment in this field a small wire recorder is shown in which the existing hard valve circuits have been replaced by germanium transistors. This unit is intended for use underground as a "notebook" in which results can be spoken.

Rajasthan's Mineral Resources

The province of Rajasthan constitutes the largest State of India, with an area of about 132,400 sq. miles. It possesses a large variety of mineral resources, the development of which has assumed great importance since the formation of this State in 1949. Exploitation has been hindered, however, by the absence of specific data about mineral resources.

Existing knowledge has been brought together by M. L. Sethi, Director of Mines and Geology, Rajasthan, in "Mineral Resources of Rajasthan," published by the Department of Mines and Geology, Udaipur, as Bulletin No. 4 (price Rs.5/8/- excluding postage).

The minerals included in the text are those which are important industrially and are deemed capable of economic exploitation. A number of them are already being worked and others are potentially valuable. It is significant that there has been a very large increase in the number of concessions granted in this State for a variety of minerals.

Hitherto the trend has been to work only those minerals which could be sold in the form of run-of-mine ore, no processing or mineral dressing being carried out. It is considered that this attitude now requires re-orientation and that there is need for beneficiation or ore dressing, which will assure industries a regular supply of standard grade mineral produce, as well as benefiting producers by enhanced sales prices and reduced production costs.

METALS EXTRACTION—II.

Extracting the Less Common Metals

At a symposium on the extraction metallurgy of some of the less common metals, held by The Institution of Mining and Metallurgy on March 22 and 23, 1956, a number of papers were presented dealing with the recovery of what previously was designated the rare metals group. These are now classed as less common metals owing to their increasing applications in industry and the development of improved exploration, mining and extraction techniques. The following article is the concluding instalment of two, wherein the facts contained in relevant papers presented at the symposium are given in précis. This concluding portion of the article discusses aspects relating to the extraction of titanium, beryllium, thorium and niobium, as well as those developments that have taken place recently in Canada.

As is well known, it is far easier to produce titanium oxide for paint manufacture than it is to obtain metallic titanium, for the difficulty encountered in producing the metal is its great affinity for oxygen and nitrogen; thus it is necessary to exclude these gases from any high temperature reaction. Hitherto it has been the custom to produce titanium sponge from the tetrachloride, and consolidate the sponge into massive metal, usually by argon arc melting. Up to the present time, chemical reduction methods have been the only processes used on a large scale to produce commercial quantities of workable metal, and these methods have been very costly; a feature which is reflected in the price of titanium metal.

For this reason a paper from the Metallurgy Department of the University of Melbourne, describing the extraction of titanium by an electrolytic method, is of interest. This paper covers work done over the past seven years at Melbourne and shows that the metal can be produced by electrolysis of lower valency chlorides of titanium in molten salt carrier electrolytes. In current experimental work the emphasis is on the development of soluble anodes and on the formation of more massive coherent cathode deposits.

While the production of titanium by electrolysis is fraught with many difficulties, the work at Melbourne shows that titanium metal can be produced in this manner. It has been demonstrated that, provided care is taken, the fine semi-adherent titanium metal deposited at the cathode is of high purity. However, the fine nature of the deposit facilitates the oxidation of the product during subsequent treatment, and when the material is finally consolidated into an ingot by melting, it is frequently brittle; it is hoped that what is termed the "hot-spot" cathode technique may go a long way towards overcoming this difficulty. This work has shown sufficient promise to warrant perseverance with electrolytic methods of producing titanium metal.

WIDER SCOPE FOR BERYLLIUM

Although a light metal, beryllium has not yet found any extensive applications in light alloy engineering, chiefly because the metal, as hitherto produced, is brittle and of no great strength. More recently, it has been found that by cross-rolling the metal, sheet beryllium may be produced having extensive ductility in all directions in the plane of the sheet. The few engineering parts that have been made of this metal have generally been produced by powder metallurgy, which gives a fine-grain product and the coarse grain of castings is thus avoided. Research in the field of atomic energy has resulted in beryllium becoming of interest in the construction of reactors as employed in nuclear power generation. Due to its low absorption cross-section for thermal neutrons and its good chemical and mechanical properties at elevated temperatures, beryllium may be employed in the construction of reactor fuel elements and for other structural applications.

In the nuclear sphere, beryllium is the only metal having properties suitable as a moderator; other materials used being non-metallic, such as graphite, etc. This relatively new use for beryllium, coupled with extended production of

both metal and compounds for other purposes, is reflected in the two papers dealing with this subject. One of these papers is from the Research and Development Department of Imperial Smelting Corporation, and describes a method of preparing beryllium metal from the hydroxide on a pilot plant scale.

By this method the beryllium is ultimately obtained in the form of beads, which are then leached in hot water to eliminate chemicals used in their production. If the beads were nearly spherical in shape, as was generally the case with beads of 1 in. dia. or less, a good surface polish was obtained; but since they were likely to contain small amounts of magnesium metal and halide fluxes, it was necessary to remove these by vacuum treatment. Furthermore, it was usually desirable to produce the metal in a consolidated form suitable for subsequent fabrication, so the beads were vacuum-melted and poured into ingot form. Ingots of 2 in. dia. were produced in a high frequency induction furnace; a beryllia crucible being used for melting, and the ingot was lip-poured through a refractory hot-top into a graphite mould provided with a water-cooled copper base.

MODIFIED COPAUX METHOD

The beryllium hydroxide as used in the foregoing process is produced by Murex, at Milford Haven, and this process forms the subject of the other paper. Because of the difficulties accompanying the extraction of beryllia from beryl ore, a modification of the Copaux method has been adopted for the production of the hydroxide at Milford Haven. One of these difficulties arises from the low atomic weight of beryllium, which means that the percentage of the element in raw material is correspondingly low, with the consequence that large quantities of ore and reagents have to be handled in relation to a small yield. Also, small atomic proportions of impurities in the final product appear as large percentages by weight. Secondly, the ore itself is not readily opened up with many of the commoner and cheaper reagents unless previously activated by heat treatment. Lastly, the prevalent belief that many compounds of beryllium are exceedingly toxic to man has enforced the use of expensive equipment to ensure that the contamination of the atmosphere of the workrooms and neighbourhood is at a very low level. This factor retards operations.

In beryl ore, which is the raw material for the plant, beryllia is present as an alumino-silicate and the BeO content ranges from 11.1 to 12.9 per cent, South Africa and Australia being the sources of supply. The ore is in the form of crystalline lumps and in most shipments pieces range up to 4 or 5 in. in dia., although much larger pieces are sometimes encountered. Ore of normal size is broken down to smaller pieces in a Kennedy gyratory crusher, the product being taken by belt and bucket elevator to storage bins. From these the ore is fed by table feeders through a blending system to a Hardinge ball mill. Two Vezin machines in series permit satisfactory control samples to be taken, and the ground ore passes to storage bins to await the results of analysis.

The hardness of beryl (7.5-8 on Moh's scale) is respon-

sible for a great deal of abrasion in the ancillary equipment of the mill, and the replacement of mild steel by rubber at zones of maximum turbulence is desirable. The processing of the material includes fluoride roasting, leaching of the roasted material and extraction of beryllium fluoride, precipitation of crude beryllium hydroxide, purification of this material, and recovery of beryllia from effluent liquors and slurries; flake metal is produced by hydroxide/carbon briquettes and kiln treatment.

CANADIAN DEVELOPMENTS

That Canada is taking an increasing interest in the production of such metals as niobium, tantalum, lithium, selenium and tellurium is shown by a paper from the Division of Mineral Dressing and Process Metallurgy, Mines Branch, Ottawa. Boreal Rare Metals is at present the only producer of niobium and tantalum concentrates in Canada, and this company's niobium and tantalum-bearing pegmatite dykes occur north of Great Slave Lake, Northwest Territories; the most important being Moose Nos. 1 and 2 and Big Hill dykes along the north shore of Hearne channel, and several other groups. These occurrences were acquired by the company in 1952. Both niobium and tantalum occur in these dykes as small widely disseminated crystals and as "rosettes" of columbite and tantalite, the latter mineral being by far the more abundant. The mineral tapiolite, which has approximately the same composition as tantalite, has also been found; both minerals being in the form of solid solutions of iron and manganese tantalates and columbates, but of different crystalline form. The grade of ore varies widely and can scarcely be determined accurately except by actual mining and treatment of appreciable tonnages. In operations to date it has been approximately 6 lb. of tantalite and columbite per ton, or about 4.5 lb. of the oxides.

It was in 1953 that the company erected a 100-ton gravity concentration mill and during the next two years a substantial tonnage of ore was treated. In January, 1955, the mill was destroyed by fire and at the moment a new 150-ton mill is in course of erection. During the time the mill operated, 30,000 lb. of concentrates consisting of 67 per cent of columbite and tantalite, or 50 per cent of combined oxides in the ratio of 4 Ta₂O₅ to 1 Nb₂O₅, were produced. While the company's major products are niobium and tantalum oxides, experimental quantities of the corresponding metals have already been produced.

A prominent Canadian source of lithium is the spodumene deposit at Cat Lake, Manitoba, where spodumene ore occurs as very fine to coarse-grained crystals in a gangue consisting of microcline, albite, quartz, garnet and muscovite. In the so-called decrepitation concentration advantage is taken of the fact that spodumene, known as alpha-spodumene, changes its crystal form if it is heated to about 1,000 deg. C. The crystal change does not reverse on cooling; the crystals are now termed beta-spodumene and they remain in the inverted and now metastable condition. In this form the crystals are friable and easily crushed. The investigation on lithium extraction from spodumene concentrates was started in the Mines Branch at Ottawa, and a commercial process has been worked out.

It is interesting to note that the Lithium Corporation of America, in its new lithium processing plant in Bessemer City, North Carolina, U.S.A., is going to process spodumene concentrates with a minimum lithia content of 4.5 per cent Li₂O to be supplied by the Quebec Lithium Corporation of Canada. The process used at this plant is the inversion of alpha-spodumene at 1,000 deg. C. to beta-spodumene and then roasting the material with sulphuric acid and calcium carbonate to produce lithium sulphate, which when leached with water is converted to lithium hydroxide.

Selenium and tellurium occur as copper selenides and copper-gold tellurides in the copper-nickel ore of the International Nickel Company of Canada, and owing to the fact that the amounts of selenium and tellurium are exceedingly small in the ore, no attempts are made to determine these amounts. The selenium and tellurium which are recovered in the copper flotation concentrates at the Copper Cliff concentrator as selenides and tellurides are collected in the blister copper after copper concentrates are smelted. Inco's blister copper is transported in molten condition from the Copper Cliff smelter to the copper refinery in specially designed cars. The molten copper is charged to the anode furnaces where the refining process begins. When the furnace is charged, the bath with the slag on top of the molten metal is covered with coke breeze and poling is started to reduce the oxygen content of the metal and also copper content of the slag. The latter is then skimmed off, crushed, sampled, and sent back to the smelter for the recovery of the metals which are in it. Selenium and tellurium are recovered from the anode metal, but they do not pass into solution in the electrolyte; they remain insoluble and drop as part of the electrolytic slimes to the bottom of the tank. Recovery of the metals is accomplished by refining the metallic slime content.

PURITY STANDARDS OF THORIUM

As the production of pure thorium metal has attracted the attention of the Atomic Energy Authority, experimental work has been carried out at the Research and Development Branch with the object of improving methods already known. Details are given of purification processes based on chlorination and on solvent extraction of concentrates prepared from monazite rock by sulphuric acid breakdown. The products from these processes are then reduced to metal by the use of calcium; for example, thorium can be reduced by calcium at temperatures up to 1,200 deg. C. to give thorium powder. Since calcium will reduce thorium halides at temperatures above the melting point of thorium, it was found possible to produce billets of thorium by reducing tetrachloride and tetrafluoride of thorium respectively; these billets, however, were not of exceptional purity.

Zirconium has acquired a new technological significance with the advent of nuclear power for this metal is of particular interest in this field because it combines resistance to corrosion with a low thermal neutron capture cross-section. On the other hand, this factor in the case of hafnium is very high; so that small traces of hafnium in zirconium considerably detract from the value of the zirconium for nuclear power purposes. A high premium is therefore placed on separating these two elements, and under this stimulus several methods have been developed in various countries. These methods, which are described in the paper, include fractional crystallization, selective decomposition, distillation, adsorption and solvent extraction.

EXPERIMENTS ON NIOBIUM

In the past few years much experimental work has been carried out on the production of high purity niobium from the well-known ferroniobium, the alloying metal for steels.

Several of the papers are devoted to the production of niobium, and a method which has been developed by the U.K.A.E.A. involves the chlorination of ferroniobium, the purification of the mixed chlorides to remove iron, separation of niobium and tantalum by reduction in hydrogen at 500 deg. C., and finally, reduction of the niobium trichloride with hydrogen at temperatures between 600 deg. and 1,000 deg. C. to give niobium metal powder. In the latter the chief impurities are gases and these are easily eliminated on sintering the powder.

MACHINERY AND EQUIPMENT

Use of Nylon in Belts and Drives

The tremendous potentialities of nylon for belting have been becoming apparent in British industry for some time past. Several types of nylon belting and drives are already achieving a high degree of success because their strength and durability makes them a long term economy and because, in some instances, they are responsible for significant increases in production.

Several types of belting and drive made wholly or partly from nylon were exhibited recently by British Nylon Spinners Ltd.

Solid-woven conveyor belting incorporating nylon in the weft has been approved by the National Coal Board and is being used extensively in coal mines. The first lengths of this type of belting were put into service in the South Yorkshire coalfields in 1952.

Nylon's advantages of high abrasion resistance and high tensile strength ensure that the fabric is extremely durable and cannot break down rapidly at the edges. The belting has a long life and requires less maintenance than conventional types. Manufacturers have devoted considerable time and energy to devising methods of taking even greater advantage of nylon's possibilities. Several other types of conveyor belting are being developed, some of them incorporating nylon in the warp as well as in the weft.

As nylon conveyor belting is thinner and lighter in weight than comparable belting made from other fibres it is considerably easier to handle and consumes less power. Its greater flexibility makes it possible to use smaller driving drums, sometimes saving valuable space.

A different type of belt, made entirely from nylon, has achieved remarkable success in a Shropshire quarry where it drives a 1,000 r.p.m. generator. Conditions are so severe that in spite of repeated trials with the toughest and most durable belts on the market nothing was found to last more than two or three months. Many of the belts broke down even more rapidly.

Addition to Lubricant Equipment Range

A new gun filler attachment manufactured by Tecalemit, Ltd., is now in production. It has the advantage that it can be used on drums containing lubricants ranging from 56 lbs. to 130 lbs. capacity.

The design incorporates provision for adjustment of the tube length. Also the lid has a rim which fits completely over the top of the lubricant package and is fitted with clamping screws to accommodate different size drums.

Grease guns can be easily charged and with the aid of the additional delivery hose, lubricants can be readily transferred to a pump or any other point ensuring that the lubricant is kept completely clean and uncontaminated by foreign matter.

Parts Handling Facilities

International Harvester Co., of Great Britain, Ltd., recently announced plans to build a new large parts warehouse on their Doncaster works site. The new building, which is to be completed during the next twelve months, may be regarded as an extension or duplication of the already large scale facilities in London, and will have a floor area of 78,150 sq. ft. The most modern handling equipment will be installed, including electric fork-lift trucks and electric gantry cranes.

Since International Harvester commenced manufacture in the U.K., production of tractors and equipment has increased rapidly and the range of industrial equipment has widened to include bulldozers, loader-dozers, scrapers, winches and now the new International Drott skid shovel. In addition to the large stocks of parts needed to provide ready service for all this equipment, the company also manufacture in the U.K., a

very high proportion of parts needed to service imported International crawler tractors.

Parts handling and warehousing has thus become a major operation and one of vital importance.

A Range of Mechanical Handling Equipment

Among the mechanical handling equipments manufactured by The British Wedge Wire Co. Ltd., are many types of conveyor belt designed specifically for the mining industry.

The creeper conveyors produced by these manufacturers can be adapted to motivate colliery or quarry tubs and are either of the chain and dog type or are chain with pusher attachments with outboard support rollers. The former type is used as a general purpose conveyor and in those situations where inclines are too steep for universal chain conveyors.

Overhead chain conveyors have a wide variety of applications in industry, and of these applications, many can be envisaged as being connected with mining or processing. Examples of these applications are shown by the use of overhead chain conveyors in the handling of cathode ray tubes, jig handling plants and in pouring foundry moulds from tipping ladles. The overhead chain conveyors manufactured by The British Wedge Wire Co. Ltd. are of two types, first the chain with load carrying trolley attached, and second the chain with trolley and pusher attachment for propelling separate load carrying trolleys.

The manufacturers' range of bulk handling conveyors includes troughed belt and drag link bucket conveyors, swing bucket conveyor—elevators and continuous spaced bucket elevators. This range is designed to handle such materials as ores, coal, sand and aggregate.

Typical applications include the use of spaced bucket elevators for handling boiler house coal, and the use of drag link conveyors fed by the foregoing units to distribute the coal handled. Within this range, the Wedco troughed belt conveyor is claimed to be the lightest in existence, water and materials spilled from the belt being carried clear of the conveyor by a specially constructed bridge section with damage by corrosion practically eliminated. The flat rubber belt picking conveyor is widely used in the coal mining industry.

These equipments are fully described in a comprehensive booklet recently published by the company.

New Welding Generator

The Murex Dynex generator is now in full scale production. One of the most important features of this new generator is that it has been specially designed for welding, and the equipment has been designed from the outset to have special advantages for welding purposes. Suitable not only for D.C. metal arc welding, but also for other processes such as argon arc welding, this new generator has been designed so that it can be supplied as a motor generator equipment and so that it can be incorporated into all Murex engine-driven equipments.

The Murex Dynex generator employs a unique principle of current control giving infinite current adjustment between maximum and minimum values throughout its entire current range at a practically constant open circuit voltage. This facility provides ideal characteristics for modern electrodes and techniques.

New Applications of Gyrotory Sieving to Industry

The Russell Laboratory Unit has been successfully applied to geological survey in the search for new wells and the same machine is used for the sieving of commercial diamonds with which the drills are tipped. In oil drilling oil-base mud with which the drill is lubricated is being strained on Russell Separators to remove the chippings so that the mud can be re-used.

Another application of interest occurs in the mining industry where it will be recalled that columbite has been sieved by the Russell Cascade Unit.

MINING MISCELLANY

Production is being stepped up in the Tasmanian Bell Bay aluminium plant, having been restricted because of a shortage of power. It is now estimated that the plant will produce about 10,000 tons of aluminium a year, which is only 3,000 tons short of the final production target.

The Paris company, Argiles-Kaolins-Derivés, has applied for an exclusive permit to prospect for copper in the area of Mas-Cabardès in the Aude Department (South-Western France).

Better coal than ever previously found in Northern Rhodesia is reported to have been proved at Kandabwe in the Gwembe Valley, 35 miles south of Choma. Although not as good as Wankie coal, recent tests carried out overseas have proved better than had been hoped.

The erection of two up-to-date sintering furnaces has been concluded at the iron ore and metallurgical establishments at Sabinow in Poland. Their production capacity is claimed to equal that of twenty of the former furnaces. The transport of crude ore from the sorting plant is now undergoing trial runs. The handling of smelted ore and its loading on to railway wagons will also be completely mechanized.

The Quebec, North Shore and Labrador Railway, built by Iron Ore Company of Canada to transport Knob Lake iron ore to Sept Isles on the St. Lawrence, has received from the Senate approval in principle of a 10-year extension it is seeking to complete the remaining 300 miles of its line to a point on Ungava Bay.

By 1958, when improvements are completed, the Lackawanna plant of Bethlehem Steel Company will be using almost 40 per cent low grade taconite ore, which is available in virtually unlimited quantities in the Mesabi range at the head of the Lakes. Research into refining and concentrating methods has brought the price down to a level where it competes with high grade ores.

Crompton Parkinson Ltd. have reserved a substantial portion of the mains cable production capacity at their Derby works for the manufacture of aluminium conductor cables. This step has been taken to meet the increasing demand for mains cable having aluminium conductors, which has come about primarily as a result of high copper prices.

In order to encourage and assist the search for mineral deposits, the Department of National Development has published a geological map of Australia and Papua-New Guinea. The scale used is 100 miles to the inch. Priced at 2s. 6d. post free, the map is obtainable from officers of the Bureau of Mineral Resources at 485 Bourke Street, Melbourne, Canberra, and Darwin.

Copies of the geological maps can be seen at Australia House, Strand, London, W.C.2., on application to the Senior Representative of the Department of National Development.

Another map of the series of airborne scintillograph maps resulting from aerial surveys for uranium is now available. It covers the Darwin-Anson Bay area in the Northern Territory.

The Civil Aeronautics Administration of the U.S. has authorized Roland F. Beers, Inc., of Troy, to conduct a testing programme lasting a month to determine the feasibility of hunting for base metals by air. Equipment made by Aero-magnetic Surveys Limited, Canada, will be used in the American tests.

On April 2, 1956, a new company, the A.E.I. Lamp and Lighting Company Limited, came into operation to market the lamp and lighting products of B.T.H., Edison Swan and Metropolitan-Vickers. The brand names *Mazda*, *Ediswan* and *Metrovick* are being retained. By amalgamating the distributive resources of the three companies it has been possible to provide a speedier and more comprehensive service to customers. The chairman of the new company is Mr. E. H. Ball, M.I.E.E., managing director of B.T.H. and a director of A.E.I. The joint managing directors are Mr. V. C. H. Creer and Mr. S. R. Eade, M.I.E.E.

The first provincial meeting of the British Occupational Hygiene Society will be held at Liverpool on April 19 and 20, in collaboration with the General Chemicals Division of I.C.I. Papers will be presented on chlorine, dust sampling, and control of the fluorine hazard.

PERSONAL

Mr. Gerald Edward Coke has been appointed chairman of the following companies in succession to the late Lord Bessborough: The Rio Tinto Co. Ltd., Rio Tinto Management Services (U.K.) Ltd., and Rio Tinto Finance and Exploration Ltd.

Mr. J. A. Griffiths has been appointed a director of East Rand Consolidated Ltd.

The engagement of Mr. J. A. C. Bergne as managing director of Siamese Tin Syndicate Ltd. and Bangrin Tin Dredging Co. Ltd. has terminated. Mr. Bergne has left the boards of both companies and intends to resume his mining consultant practice.

Mr. Michael H. L. Lewis, M.A., has been elected a director of Crompton Parkinson Limited. Mr. Michael Parkinson, M.A., has been appointed an executive director of Crompton Parkinson Limited.

Mr. K. Adamson and Mr. W. D. Harley-Mason have been appointed to the board of The Gabriel Manufacturing Co. Ltd., a subsidiary of Tecalemit Ltd. Mr. Harley-Mason assumes the title of general manager of the subsidiary company.

Sir Bernard Keen and Mr. A. G. P. Powell have been elected to the board of Baird and Tatlock (London) Ltd. and Mr. W. C. Johnson and Mr. H. N. Ricketts to that of Hopkin and Williams Ltd.

Mr. S. R. Howes, at present director and general manager of Samuel Fox and Co. Ltd., of Stocksbridge, will retire on June 30, but will remain on the board. He will be succeeded by Mr. H. P. Forder, at present director and deputy general manager of the branch.

Notices of the following forthcoming meetings have been received from the Institution of Mining Engineers: summer meeting of the Institution, Edinburgh, June 20-22; Manchester Geological and Mining Society, Wigan, April 19; Midland Counties Institution of Engineers, Ashby-de-la-Zouch, April 18; Midland Institute of Mining Engineers, Sheffield, May 3; Mining Institute of Scotland, Glasgow, May 26; South Staffordshire and Warwickshire Institute of Mining Engineers, Cannock, April 18; South Wales Institute of Engineers, Cardiff, April 19 and May 17.

The Oakland Metal Co. Ltd. have installed Telex equipment in their London offices. Their telegraphic address is now "Amomet-London-Telex".

The National Metal Exposition and Congress of the American Society for Metals will take place in Cleveland from October 8-12, 1956.

The summer meeting of the Institution of Mining Engineers will be held in Edinburgh on June 20, 21 and 22.

The Iron and Steel Exposition will be held in the Public Auditorium, Cleveland, on September 25-28. Application blanks and floor plans are available from the Association of Iron and Steel Engineers, Empire Building, Pittsburgh 22, Pa.

The 1956 Mining Show of the American Mining Congress will take place in Los Angeles, October 1-5.

CONTRACTS AND TENDERS

A new order valued at \$45,000 has been received from the Philippine Islands by Martin, Black and Co. (Wire Ropes) Ltd., of Coatbridge. The order is for logging ropes. The total rope supplied will weigh approximately 92 tons and will be 167,000 ft. long.

The International Co-operation Administration (I.C.A.) has announced the following future authorization:

Korea. Issuing authority, Office of Supply, Government of the Republic of Korea, Seoul. TEN./18799. Dynamite gelatin, blasting caps and safety fuse. Procurement Authorization No. 89-390-99-A6-6420. Closing date: April 27, 1956. B.O.T. Ref.: ESB/9087/56/ICA. Telephone enquiries to Chancery 4411, Extension 360.

METALS, MINERALS AND ALLOYS

COPPER.—During the last week or so, it has no doubt been a source of gratification to those who have urged the ending of fixed price policies as being the quickest way to bring down free market prices, to observe the way in which the L.M.E. price has behaved since Anaconda and Kennecott announced their decision to sell on this price basis. Already at the middle of this week, the cash price in London was below the 48 c. level where less than three weeks ago it was a round 53 c. Similarly, U.S. custom smelters, which a fortnight ago were quoting 55 c., are now quoting 50-51 c. with some dealers reported to be asking 52 c. for April metal. There is thus only a spread of 6 c. between the U.S. producers' fixed price and the highest price asked in free markets. This is a great improvement, but barring strikes it should only prove to be a beginning.

Meanwhile, as the range of prices narrows, the argument becomes all the stronger for tidying the present multiplicity of prices bases. Thus, at the moment, we seem to have about ten more or less widely used prices; namely, the L.M.E. price itself; the Anaconda and Kennecott prices for Chilean production (which are both based on, but not identical to L.M.E. pricing basis, and which vary slightly with each other), the R.S.T. price; and the Belgian Congo producers' price. Then in North America we have the domestic producers' price; the custom smelters price; the Canadian price; the Comex price and the E. and M.J. weekly average. This is unnecessary bedlam. Once upon a time copper, for all practical purposes, was either dealt in at the L.M.E. price or the Comex price, or the U.S. producers' quotation.

Not surprisingly the American fabricators have had to adjust their prices to allow for the higher cost of their Chilean intake and this week the price for mill products appeared to be settling down at around 47½ c.

Anaconda's annual report makes impressive reading. Copper production from all the group's properties together amounted last year to 535,251 s.tons, an increase of 25 per cent over 1954, to which domestic production largely contributed. The report refers to three new projects in the Butte (Montana) district in addition to the Greater Butte copper project, which is now working to capacity. Of these, the most immediately interesting is the Berkeley Pit opencast development, south of the Kelley mine, where 100,000,000 tons of 0.8 per cent copper have been disclosed. A tentative programme envisages an annual rate of output of 32,500 s.tons of refined copper by the middle of 1957. The most significant item in the report is the statement that the group's aluminium subsidiary—Anaconda Aluminium Company at Columbia Falls—reached its full rated output capacity of 60,000 tons of aluminium a year last December.

Following the lightning strike at Mufulira, now settled, the European Mineworkers are to declare the existence of a dispute on whether or not job categories affected by the African advancement scheme should be transferred simultaneously in respect of all jobs in a given category, or whether transfers should occur as and when African personnel are available to take over. The Mufulira stoppage arose over a situation in which European and African pipe-fitters found themselves working side by side. On the face of it this objection by the European Mineworkers would appear to be a nonsense as a progressive transfer of jobs (which we had always understood was envisaged in the agreement) is surely the only way in which the changeover can be effected smoothly and without interruption to production.

The Chibuluma copper-cobalt mine, which began hoisting ore last October, will commence operation on its concentrator on May 5. The copper concentrate will be smelted at Mufulira, while the cobalt concentrate will be treated at a plant which R.S.T. group is erecting at Ndola and is expected to be ready by the end of this year. This plant will produce a matte containing 10 per cent cobalt which will be shipped to Europe in that form. Meanwhile the cobalt concentrates will be stockpiled. At full capacity working the concentrator is expected to yield 16,000 tons of copper and 500,000 lb. cobalt.

LEAD.—Preliminary figures issued last week by the Bureau of Mines indicate that supplies of lead available in the U.S. during 1955 were again, for the fourth successive year, in excess of demand, although thanks to the stockpiling programme, not an embarrassment to the market. Supplies from all sources totalled 1,275,000 s.tons, of which 333,400 s.tons came from domestic mine output, 500,000 s.tons from the recovery of secondary metal, and 441,600 s.tons from imports. Consumption, excluding stockpile offtake, is estimated at 1,205,000 s.tons, the excess supply of 70,000 s.tons being the smallest for some years. Producers' and consumers' stocks both decreased during

the year, the former were 78,900 tons on January 1, and 23,400 tons on December 31, while the latter were respectively 124,600 and 115,100 s.tons.

The U.S. demand for lead has not been very brisk in the past week, with consumers showing an inclination to run down stocks. Recent weeks have, of course, been the seasonal low point for battery manufacturers, but their requirements are expected soon to go ahead. In this context it is notable that battery shipments during the first two months of this year were ahead of last year at 3,307,000 units compared with 3,125,000 units in the same period a year ago.

TIN.—There has been no further news this week regarding the rumoured six months' extension to the Texas smelter (see M.J. last week, p. 415). It has, however, been pointed out in the American press that although the Indonesian and Congo contracts nominally expired on March 20, while the Bolivian contract terminates at the end of this month, in fact, allowing for shipping time, deliveries under these contracts will be flowing into the Texas smelter well into May or longer. One possibility, if profitability is not a primary consideration on this essentially political issue, would be for the smelter to continue to operate on a very much reduced monthly output during the second half of this year which would reduce the immediate urgency of placing additional contracts for ores. A development of this sort would certainly place the Indonesian authorities in an interesting dilemma.

According to a report in the *Metal Bulletin*, an important tin ore deposit has been discovered at Tambillo in the Province of Huaraz, about 200 miles north of Lima. Claims covering a total of 30,000 hectares (approximately 115 sq. miles) had been registered up to the middle of December. This is believed to be the first deposit of tin-bearing ore to be found in Peru and its mineral content is said to vary between 10.85 and 9.75 per cent.

ZINC.—The Bureau of Mines has recently released provisional figures for the U.S. zinc industry in 1955. These are characterized by an all-time record for smelter production at 1,031,000 s.tons (including 72,000 tons of secondary) compared with 870,000 s.tons (including 68,000 tons of secondary) in 1954. Slab zinc consumption was also a record, at about 1,114,000 s.tons or about 26 per cent above last year, and 13 per cent above the previous record in 1953. Domestic mine production of zinc was well up on 1954 at 504,000 s.tons against 467,000 tons despite strikes which lost the industry some 20,000 tons. Imports rose to 687,000 s.tons against 611,000 tons, although still below the all-time record of 748,000 tons in 1953. Smelter stocks fell during the year from 120,000 to 41,000 s.tons, while consumer stocks rose from 102,000 to 119,000 s.tons.

ALUMINIUM.—Forecasts by leaders of the aluminium industry become more and more ambitious as usage continues to expand. According to Mr. John H. Krey, vice-president and assistant to the president of Reynolds Metals, the industry has hitherto tended to be unduly conservative in its predictions. Mr. Krey's own assessment is a demand of 3,000,000 s.tons in 1960 with requirements rising to 4,000,000 tons by 1965. Certainly the short-term outlook is increasingly encouraging. For instance, it has been reported from the U.S. that the gradual decline in the backlog of unfilled orders for the aircraft industry was reversed about the second quarter of last year, when new sales began equalling and even exceeding the rate of shipments. U.S. aluminium producers now have approximately \$16,000,000,000 worth of orders on their books, representing an increase of about \$1,000,000,000 over the amount a year ago. Chief factors contributing to the reversal of the trend are the continued expansion and replacement buying by the commercial airlines and more recently the bookings of orders for commercial type aircraft.

Still further potentialities seem indicated by a new process developed by the Federal Pacific Electric Co., which is claimed to solve the problem of practical utilization of substantial amounts of aluminium for electrical conductors and connections with existing copper alloy materials.

Rumours have recently been current that Reynolds Metals were actively negotiating a working agreement with Strategic Metals Corporation of Buffalo and Montreal in connection with a process for producing aluminium oxide from waste material. An official of Reynolds has stated, however, that there are no negotiations under way at present, though there have been some discussions in the past. It is evident that such a process, if it could be operated successfully on a commercial scale, might have far-reaching effects on the economics of the aluminium industry.

Alcoa has announced plans to construct a \$45,000,000 plant at Point Comfort, Texas, for the production of alumina. The new plant will produce over 500,000 tons of alumina annually for the company's primary aluminium smelters at Point Comfort and Rockdale, Texas. Production is expected to start in early 1958 and present expectations are that the initial capacity will be doubled by 1965. Alcoa will also build at Point Comfort a \$3,000,000 ore unloading dock and a navigation channel capable of accommodating 25,000 ton bauxite carriers operating between the plant site and the Gulf of Mexico.

NICKEL.—Demand for available supplies of nickel remains at a very high level and very high prices are prevailing on the open market. The domestic requirements of the U.K. are largely met by supplies from Canada at the fixed price of £519 a ton, delivered consumers' works, but in the open world market dealers are asking from £1,500 to £2,000 a ton. It is believed that virtually no Japanese nickel will be available until early in 1957, the price mentioned in this connection being £1,800 a ton.

One reason for the continued shortage of nickel is, of course, the growing demand for stainless steel of which chromium and columbium are also constituents. It is interesting to note, therefore, from a report by the American Iron and Steel Institute that during 1955 mill shipments of stainless and heat-resisting steels from the U.S. increased by nearly 135,000 tons. The total for last year was 686,449 tons compared with 452,351 tons in 1954.

It has been announced that four North American concerns—American Smelting and Refining, Freeport Sulphur, Hanna Coal and Coke Corporation, and International Nickel—as well as two Philippine concerns—Surigao Consolidated Mining and Benguet Consolidated Mining—are planning to take part in developing large nickel/iron deposits in the south-eastern Philippines. The report mentions \$100,000,000 as the initial amount to be invested, but does not indicate whether the six concerns will operate separately or as a joint concern.

PLATINUM.—Johnson, Matthey and Co. Ltd. have announced their intention of assisting, to the best of their ability, the British Government's endeavour to halt the progress of inflation. They cannot avoid varying their selling prices to the extent of any variations in the prices of the precious or other metals contained in their products, but they can control their charge for work performed. The company has decided, therefore, that its refining and manufacturing charges will not be increased during a period of six months from February 1, 1956, and that at the end of that period the possible extension of this undertaking for a further six months will be considered in the light of conditions then obtaining. This applies, of course, not only to platinum and platinum group products, but to all the other refined metal and manufactured products with which this company is associated.

ZIRCONIUM.—Although zirconium appears to be the most promising material for use in reactors, it has the disadvantage of high cost, the price of the metal in the U.S. being currently \$30 a lb. This gives particular significance to an announcement that Bureau of Mines metallurgists have developed a low-cost method for producing zirconium-alloy ingots that will meet exacting specifications for use in building atomic reactors. Essential features of the method are the use of small metal alloy pills, which are fed into the arc furnace during melting, stirring of molten zirconium with an electric circuit, and remelting the resulting ingot to improve distribution of the alloys. Over 30 ingots, each weighing from 300 to 500 lb., have been made by this method.

DIAMONDS.—A new company, Sandwich Bay Diamonds, has acquired the exploration rights for an area of approximately 700 sq. miles to the south of Walvis Bay. The new field, which has not previously been explored, is at Sandwich Harbour, some 35 miles from Walvis Bay and extends southwards along the coast for approximately 24 miles. It is understood that a considerable sum of money is likely to be spent on full scale exploration work.

The London Metal Market

(From Our Metal Exchange Correspondent)

The copper market has been influenced by the recent holidays, and with home and Continental enquiry rather slow prices slipped back early in the week. An increase in warehouse stocks led to freer offerings of cash, and the backwarrant narrowed to about £3 at one time although it has since increased again. On Monday afternoon it was learned that 1,300 European daily paid workers at Mufulira copper mines had "walked out" over a labour dispute, and on Tuesday a general strike in the Rhodesian copper belt was threatened:

consequently there was some recovery from the low level reached on Monday morning. It now seems that the men on strike have agreed to return to work, and prices have resumed the downward trend at any rate for the time being.

There has been no special feature in the tin market, and with Continental and home requirements on the quiet side it appears that Straits tin has been put into warehouse. Official warehouse stocks at the end of last week showed an increase of 103 tons to 1,150 tons. It now seems likely that the Texas City smelter will remain in operation until the end of January, 1957, and presumably the resulting production will be absorbed by the stockpile. On Thursday morning the Eastern price was equivalent to £775 per ton c.i.f. Europe.

Lead prices have tended to ease, probably in sympathy with the weakness in copper, and the backwarrant has shrunk to about £1 per ton. Consumer demand is rather dull, and there seems to be evidence that some works have metal surplus to their requirements which they have been willing to resell.

The zinc market has been only moderately active with price movements insignificant. Consumer demand is not very brisk and buying has been mainly for immediate requirements.

Closing prices and turnovers are given in the following table:—

	April 5		April 12	
	Buyers	Sellers	Buyers	Sellers
Copper				
Cash	£396	£397	£377	£377½
Three months	£391½	£392	£371	£377½
Settlement	£397		£377½	
Week's turnover	3,625 tons		5,850 tons	
Tin*				
Cash	£768	£769	£766	£767
Three months	£764	£765	£760	£761
Settlement	£769		£767	
Week's turnover	885 tons		765 tons	
Lead				
Current half month	£119½	£119½	£117½	£118
Three months	£118	£118½	£116½	£117
Week's turnover	2,575 tons		4,050 tons	
Zinc				
Current half month	£99½	£99½	£98½	£99
Three months	£97½	£97½	£97½	£97½
Week's turnover	4,900 tons		5,000 tons	

OTHER LONDON PRICES—APRIL 12

METALS

Aluminium, 99.5%, £189 per ton	Nickel, 99.5% (home trade) £519 per ton
Antimony—	
English (99%) delivered, 10 cwt. and over £210 per ton	Osmium, £24/27 oz. nom.
Crude (70%) £200 per ton	Osmiridium, nom.
Ore (60% basis) 23s. 6d./24s. 6d. nom. per unit, c.i.f.	Palladium, £8 0s./£8 10s. o.
	Platinum U.K. and Empire: Refined £34 0s. oz. Imported £38 0s./£40 0s. oz.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Rhodium, £40/£42
Cadmium 12s. 0d. lb.	Ruthenium, £16/£18 oz.
Chromium, 6s. 11d. lb.	Quicksilver, £86 ex-warehouse
Cobalt, 21s. lb.	Selenium, 112s. nom. per lb.
Gold, 249s. 1½d.	Silver, 78½' 1.oz. spot and 78½' f.d.
Iridium, £29/31 oz.	Tellurium, 15s. 16s. lb.
Manganese Metal (96%-98%) £269 according to quantity	
Magnesium, 2s. 4d. lb.	

ORES, ALLOYS, ETC.

Bismuth	60% 8s. 3d. c.i.f.
	30% 5s. 0d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semi-friable) 48%	£15 2s. 6d. per ton c.i.f.
" Refractory 45%	£14 2s. 6d. per ton c.i.f.
" mals 42%	£12 2s. 6d. per ton c.i.f.
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite, Raw (ground)	£21 0s./£22 0s. d/d
Molybdenite (85% basis)	8s. 2½d. nom. per lb. c.i.f.
Wolfram and Scheelite (65%)	26s. 0d./26s. 0d. c.i.f.
Tungsten Metal Powder (98% Min. W.)	21s. 0d. nom. per lb. (home)
Ferro-tungsten (80%-85%)	18s. 0d. nom. per lb. (home)
Carbide, 4-cwt. lots	£39 3s. 9d. d/d per ton
Ferro-manganese, home	£59 10s. 0d. per ton
Manganese Ore Indian	
Europe (46%-48%) basis 125s. freight	102d./105d. per unit c.i.f.
Manganese Ore (43%-45%)	97d./98d. per unit c.i.f.
Manganese Ore (38%-40%)	90d./92d. per unit
Brass Wire	3s. 6½d. per lb. basis
Brass Tubes, solid drawn	2s. 11½d. per lb. basis

COMPANY NEWS AND VIEWS

Diamond Sales Fall

Diamond sales effected through the Central Selling Organization on behalf of South African and other producers during the quarter ended March 31, 1956, were substantially lower—both in the gem and industrial categories—than those effected during the March quarter of 1955.

Quarter 1956	Gems £	Industrials £	Totals £
March 1955	11,689,779	5,127,389	16,817,168
December	11,675,034	6,512,102	18,187,136
September	11,138,534	5,581,583	16,720,117
June	12,209,324	5,004,301	17,213,625
March	15,231,054	6,936,763	22,167,817
Total for 1955	50,253,946	24,034,749	74,288,695

While it is likely that the fall in gem sales reflected a lack of available stones, lower figures for industrials may have been due to reduced activity by U.S. stockpile authorities. Yet sales of industrials have been somewhat erratic in past quarters, and undue weight should not, therefore, be given to the latest return.

Vaal Reefs Requires a Further £2,150,000

In his statement to shareholders of Vaal Reefs Exploration and Mining Company, Mr. J. W. Shilling, the chairman, announced that the company required a further £2,150,000 to finance its gold and uranium operations. Considerable extra money had, he said, been expended on the No. 1 Shaft system to that originally estimated. Moreover, it had been found possible to achieve a higher rate of advance in development than expected. Allowing for further expenditure on such items as surface buildings, services, equipment, European housing and boreholes, additional funds totalling some £1,750,000, therefore, would be needed in respect of gold. In the case of uranium, about £400,000—representing excess expenditure over the original A.E.B. loan of £2,200,500—was necessary for the plant. But the company did not intend to approach the A.E.B. for this money.

Although Vaal Reef's total additional expenditure would be met by means of temporary borrowings from the Anglo American Corporation, consideration would, in due course, be given to the question of more permanent financing.

Rhodesia-Katanga Company

Total assets at December 31, 1955, moved up to £1,318,672 from £1,195,816 at the end of the preceding year. Fixed assets including 592,500 shares of £1 in Kansanshi Copper Mining shown at cost of £710,761 (£648,261) totalled £1,037,597 compared with £975,097. Current assets included quoted investments at £211,767 (market value £127,175) and totalled £281,075. This compared with current liabilities of £63,137. Captain Rt. Hon. Charles Waterhouse is chairman. Meeting, London, April 26.

Post-War Record for Rand Labour

The number of Africans employed by South African gold mines at the end of March totalled 337,207 against 331,588 in February. This constituted a post-war record. As March is normally the period during which the yearly labour peak is reached, it is possible at this point to anticipate an overall improvement for 1956. The additional numbers available are largely due to the exceptional drought conditions at the beginning of this year in what is normally the rainy season. The benefits to the large number of mines operating below capacity of even a short term boost of the increased labour supply should not be underestimated.

Rand and O.F.S. Quarterlies

As we go to press, quarterly reports have been received from the Union Corporation and Anglo-Transvaal Consolidated groups. Amongst returns from Union Corporation, that from St. Helena was most encouraging. Average values were sharply increased to 418 inch dwts. from 357 inch dwts. while payability at 61 per cent was little changed from that of the previous quarter. For some time development results at St. Helena have been yielding higher values, and it had been hoped that this

better trend would continue. In the Anglo-Vaal group some extremely good results were reported by Virginia. Payable footage amount to 3,040 ft. representing 54 per cent of that sampled while values were vastly improved at 404 inch-dwts. from a previous average of about 320 inch dwts. On the other hand, at Merriespruit, values declined to 364 inch dwts. from 451 during the previous quarter. Payability was 53.5 per cent against 60.2 per cent.

The following are details of the March monthly returns:—

Company	March, 1956 Tons (000)	Yield (oz.)	Profit* (£000)	Year end	Current Financial Year Total to date Tons (000)	Yield (oz.)	Profit* (£000)	Last Financial Year Total to date Tons (000)	Yield (oz.)	Profit* (£000)
Goldfields										
Doornfontein	57	23,093	88.3	J	470	189,632	748.8	448	155,386	759.4
Libanon	98	21,586	51.7	J	874	191,191	505.5	881	185,027	474.7
Luipaards Vlei	125	16,630	272.9	J	1,116	159,232	573.0	1,024	191,806	376.4
Rietfontein	26	5,851	18.3	D	78	17,655	55.0	79	17,901	61.0
Robinson	78	16,770	8.7	D	234	51,354	31.3	260	55,135	77.2
Simmer	105	17,705	16.2	D	303	52,935	42.3	352	59,311	43.8
Sub Nigel	67	20,349	71.2	J	596	186,404	685.4	595	195,600	837.7
Venterspost	124	28,855	75.2	J	1,084	256,791	676.0	951	234,768	569.2
Vrolijkheid	40	14,609	52.7	D	117	42,773	210.4	116	38,533	220.8
Vogels	100	25,301	104.8	D	803	77,044	417.8	308	79,560	336.6
West Drie	71	63,908	518.1	J	568	454,814	3617.1	438	332,793	2578.7
Anglo										
American										
Brakpan	109	18,542	16.6	D	319	54,400	42.6	318	53,908	42.4
Daggas	211	47,969	270.0	D	616	140,610	795.4	663	151,625	935.0
East Daggas	96	15,782	35.8	D	285	46,965	106.9	282	47,276	142.1
F.S. Geduld	292	45,734	35.1	J	105	35,093	76.9	—	—	—
Lorraine & K.	45	7,314	125.9	S	251	41,352	1169.3	—	—	—
P. Brand & K.	54	42,930	355.1	S	312	251,178	2078.2	—	—	—
P. Steyn & K.	85	31,534	180.4	S	500	181,941	1015.3	—	—	—
S.A. Lands	87	17,210	49.9	D	257	50,755	146.0	285	53,468	169.9
Springs	126	15,378	12.1	D	376	46,164	38.9	351	47,517	23.5
Welkom & K.	84	18,090	27.1	S	492	103,476	122.6	—	—	—
W. Hold's & K.	77	29,301	176.2	S	348	161,755	1014.4	—	—	—
W. Reef Ex.	122	23,788	49.3	D	350	69,054	145.3	353	65,818	166.2
Central										
Blivvoor	108	59,844	423.9	J	939	531,559	3861.4	926	134,785	4104.5
City Deep	145	28,508	3.1	D	433	84,268	8.3	479	91,185	18.8
Cons. M.R.	171	23,727	9.4	J	1,523	216,572	146.9	1,559	226,002	242.3
F.S. Geduld	292	45,734	35.1	D	844	135,183	110.5	866	140,379	145.5
D. Roodep't	182	31,376	52.0	D	528	90,287	147.4	524	88,455	142.3
E. Rand Pr'p	216	56,156	185.6	D	617	159,420	528.1	629	148,044	450.5
Harmony	82	32,642	171.0	J	859	250,567	1,281.0	301	107,801	336.9
Modder B.	53	5,528	10.7	D	156	16,110	1.8	167	16,763	3.1
Modder E.	136	14,064	5.0	J	1,165	123,049	61.9	1,104	124,893	137.6
Rose Deep	44	7,412	0.7	D	134	22,248	6.7	182	28,689	26.6
Welgedacht	34	3,934	10.8	J	304	34,677	4.0	300	34,985	12.3
J.C.I.*										
E. Champ.	17	932	6.0	D	50	2,939	218.1	59	4,549	17.4
Freddies C.	57	11,694	148.0	D	198	35,875	1,147.2	267	49,462	1,135.3
Govt. G.M.	237	30,956	118.7	D	697	89,922	56.0	772	101,207	117.2
Randfontein	248	24,608	100.2	D	751	73,525	330.9	770	88,096	265.4
Union										
E. Geduld	145	44,595	317.3	D	416	129,188	915.9	436	134,085	1011.7
Geduld Prop	104	16,525	35.5	D	319	45,091	109.2	295	49,483	136.4
Grootevlei	195	42,209	232.4	D	565	122,309	668.3	555	119,880	676.4
Marievale	71	18,638	86.3	D	208	54,439	249.8	222	54,555	261.4
St. Helena	96	28,323	152.8	D	278	84,478	453.1	308	65,689	329.6
Van Dyk	82	13,123	1.6	D	240	39,040	3.9	239	39,597	4.5
General										
Ellatong	32	7,682	435.3	D	94	22,730	94.3	89	27,602	144.3
S. Roodep't	28	6,266	22.2	J	247	56,362	200.1	247	53,417	182.0
Stiffontein	90	35,332	2207.2	D	257	100,973	596.8	249	97,942	620.9
W. Rand C.	239	24,597	7241.4	D	680	69,253	679.9	692	80,844	650.8
Transvaal										
Harteb't'n	57	27,026	152.5	J	463	203,173	1016.3	—	—	—
Mernesspruit	75	16,948	50.1	M	—	—	—	—	—	—
N. Klerksd'p	12	1,429	88.5	D	32	3,926	21.9	33	4,237	14.1
Rand Leases	175	27,738	10.9	J	1,583	252,772	217.5	1,658	276,062	415.1
St. Helena	34	5,002	9.0	J	326	45,304	84.2	309	46,466	90.6
Virginia	78	17,187	118.2	J	647	139,015	831.8	304	58,483	61.3
Others										
Nigel Gold	34	4,029	3.2	D	95	11,230	5.0	70	10,913	6.5
N. Klein'n	107	12,505	3.5	D	313	36,811	10.0	312	37,828	14.0
Sparwater	11	3,040	0.7	D	32	9,037	2.1	33	8,503	3.0
Wit. Nigel	18	3,944	7.4	J	165	34,699	71.2	160	35,662	88.1

* Working Profit figures includes Sundry Revenue.

† Working Profit.

‡ Gold and Uranium.

L indicates loss.

a including Bird Reef, milled 40,000 tons, recovered 1,578 oz., profit £57,000 from gold and uranium. Subject to adjustment and before provision of quarterly loan instalment of £77,100.

b including £52,000 uranium profit—before quarterly loan and instalment repayments of £72,000.

c after crediting £43,000 estimated uranium revenue.

d after crediting £13,097 estimated revenue from pyrite.

e after crediting £375,000 estimated net revenue from uranium and acid.

f after crediting £329,000 estimated profit from uranium.

g after crediting £12,000 from uranium, before deductions of £750.

h excluding uranium profit which is declared quarterly.

i after crediting £111,970 from acid and uranium; before deducting repayments of £17,250.

j In future figures to be published quarterly.

k Owing to change in financial year end, previous year's figures not comparable.

m including £4,615 estimated profit from uranium.

Production Resumed at Ariston on February 27

Speaking at the meeting of Ariston Gold Mines held earlier this week, Major General W. W. Richards, the chairman, stated that productive operations had been resumed at the mine on February 27. The general manager, he said, had reported 31,330 tons of ore crushed during March for a recovery of 7,747 oz. of gold. Working profits had been £8,746. It was hoped, General Richards continued, that the current month's production would be back to normal.

United Tin and the Columbite Market

In his statement to shareholders of United Tin Areas of Nigeria, for the year ended June 30, 1955, Mr. A. Hedley Williams, the chairman, referred to difficulties experienced in the columbite market since cessation of buying by the U.S. Government. There was, he said, as yet, no definite sign of any great demand from commercial users. Because of this, a contract, for which the price per ton was to be agreed, on or before July 1, 1955, for the sale of 60 tons of columbite (in which Ribon Valley (Nigeria) had a one-third interest) had not been implemented. On the other hand, the demand for tin had remained fairly steady. As at June 30, 1955, U. Tin's total assets moved up to £317,286 from £236,046 at the end of the preceding period. Of this figure fixed assets represented £173,790 against £94,557. Quoted investments shown at cost of £35,422 had a market value of £47,651. Current assets of £96,521 compared with current liabilities of £93,991. Meeting London, May 3.

Anglo-Burma's Agreement with Burma Government

Speaking at the meeting of Anglo-Burma Tin Company, the chairman, Mr. F. R. Cottell, gave details of the method under which the company's mines would be operated as a joint venture in partnership with the Burma Government. While full details of the agreement appear in the chairman's speech (opposite), the essential factor is that shares in a new Burmese registered private company, which is to be formed for the purpose, will be held as to 49 per cent by Anglo-Burma and 51 per cent by the Government.

ANGLO-BURMA TIN COMPANY

The Twenty-Ninth Annual General Meeting of the Anglo-Burma Tin Company Limited was held on April 11.

Mr. F. R. Cottell, the chairman, presided, and in the course of his speech said:

Current assets amount to £86,450 and, after deducting current liabilities, we have net current assets of £67,529 against £75,132 at May 31, 1954.

With the constantly increasing difficulties of tribute working, expenditure exceeded revenue in the year under review by approximately £7,000. Adding depreciation of fixed assets and a small sum for taxation, there is a loss for the year of £19,110. It is clear that to operate profitably in the future it is essential for normal plant operations to be resumed. Given the necessary conditions for these operations we feel confident that our mining leases can be worked with satisfactory results.

In the latter part of 1953 the Burma Government approached us with an invitation to submit proposals for a joint venture under which your mines would be operated in effect in partnership with Government. Your Board thought it proper and appropriate to participate in such a venture provided reasonable terms could be agreed.

Negotiations were therefore entered into with the Burma Government and are now proceeding on the basis that a new, Burmese registered, private company is to be formed which will acquire your Company's physical assets in Burma, the consideration for which is to be satisfied by the issue of shares of the new company. The Burma Government will subscribe in cash for shares in the new company and thus provide that company with funds for working capital and mechanization. It is proposed that the shares to be issued against the valuation of our assets shall amount to 49% of the new company's capital and that Government's cash subscription will be 51% thereof. Having in mind the financial, political and security considerations involved your board is convinced that co-operation with Government in this manner will offer the best opportunity for mutually profitable operations in the future.

It is hoped to complete the negotiations referred to at an early date and to execute an Agreement with the President of the Union of Burma. Full details of the Agreement will be submitted to an Extraordinary General Meeting when shareholders will be asked to ratify the Agreement; thereafter ratification by the Burma Government will also be required.

The report and accounts were adopted.

ARISTON GOLD MINES

The twenty-sixth Annual General Meeting of Ariston Gold Mines (1929), Ltd., was held on April 10 in London.

Major-General W. W. Richards, C.B., C.B.E., M.C., Chairman, presided.

The Chairman said:—

Productive operations were resumed on the Mine on February 27 last. The General Manager now reports that during the month of March 31,330 tons of ore were crushed for a gold recovery of 7,747 ozs., showing an estimated revenue of £96,450 and a working profit of £8,746. We hope that the current month's production will be back to normal, as Mr. F. Clelland reported that an appreciable amount of gold has been locked up in the plant by way of plant absorption.

UNDERGROUND DEVELOPMENT

Our General Manager, together with our Consulting Engineers and Industrial Consultants, West African Gold Corporation Limited, are now actively preparing the comprehensive underground development programme to be embarked upon. The work will be started as early as practicable, after ensuring that there will be no interference with current production. The intention is to open up the lower sections of the Mine down to the 30th level.

Work has been resumed in the Gamma section of the Mine which is between our most southerly workings and the Gold Coast Main Reef Limited areas. Driving North on the 3rd Level has been restarted. Reef has now been exposed on this Level showing values of 14.82 dwts. over 77.8 inches, equal to 1.153 inch dwts. for a distance of 140 feet. Driving South on the 6th Level will be resumed as soon as it has been equipped, in order to explore the area between the Gamma Shaft and the boundary. Old records indicate high values on the 2nd and 3rd Levels in this area.

DIVIDEND

Members will appreciate that the Company's cash position does not permit resumption of payment of Dividends at this time, but this matter will be the first concern to the Board as and when the progressive results for the remaining six months of the current financial year become available.

I visited the Gold Coast recently and called a conference at Takoradi of Mines' Managers and Consulting Engineers, when policy was laid down, and I took the opportunity to congratulate the Staff on the excellent recovery they have made and the rapid resumption of operations.

CHAIRMAN'S REVIEW

The following is an extract from the Chairman's Review and the Report of the Directors for the year ended September 30, 1955:—

The activities of the Company have recently been overshadowed by the general strike of African employees in the Gold Coast gold mining industry for a 15% all round increase in wages, back dated to October, 1953, which lasted for just over three months from November 20, 1955.

During the period of the strike there was, of course, a complete cessation of revenue. Although the General Manager and his staff will do everything they possibly can during the remainder of the current financial year to make good the shortfall, the Board feel that it is their first duty to apply the revenue which will now come to hand following the resumption of operations to the building up of the Company's liquid resources.

PRODUCTION AND ORE RESERVES

During the financial year the new Winder at the Central Shaft was able to demonstrate its ability to handle not less than the rated capacity of 40,000 tons of ore monthly. 455,730 tons of ore were milled during the year, against 398,850 tons for the previous year.

The total Bullion Revenue for the year was £1,668,179 against £1,636,684 for 1954, an increase of £31,495. The average price realized per ounce of gold was 251s. 3d. against 249s. 7d. per ounce last year.

The profit for the year amounted to £206,274. The Board recommends the transfer of £130,000 to General Reserve, and the allocation of £10,000 in respect of "net additional taxation, etc." which latter is to cover the increased charge due to the provision for African gratuities not being allowed for tax purposes. The amount to be carried forward to the current year will then be £80,279, as against £78,710 brought in.

The Ore Reserves at September 30, 1955, were computed at 2,466,329 tons of an average value of 6.47 dwts., a decrease of 218,013 tons and of 0.11 dwts. in the average value as compared with the preceding year's figures.

The Report and Accounts were adopted.

ANGLO AMERICAN CORPORATION OF SOUTH AFRICA, LIMITED

(Incorporated in the Union of South Africa)

MINING COMPANIES' REPORTS (abridged) for the year ended 31st December, 1955

(All Companies mentioned are incorporated in the Union of South Africa)

SPRINGS MINES LIMITED

CAPITAL: Authorised and Issued—£2,527,500 in 10,110,000 Shares of 5s. each, fully paid.

Tons milled 1,454,000. Yield (per ton, 2.59 dwt.) .. 187,522 oz.

Income and Expenditure Account	£	Appropriation Account	£
Revenue (per ton milled 32/4.8)	2,355,695	Taxation:—	
Working Costs after transferring £1,071 from working costs reserve (per ton milled 30/8.8)	2,234,606	Union Government Income Tax	3,804
Working Profit (per ton milled 1/8.0)	121,089	Provincial Tax	761
Sundry Revenue, less Expenditure	1,366	Government's share of Profits under Mining Lease Dividend No. 66 of 54d. per share	221,156
Total Profit	122,455	Directors' Special Remuneration	7,500
Add—		Balance unappropriated at 31st December, 1955 ..	435,223
Balance to credit of Appropriation Account at 31st December, 1954	444,371		
Silicosis Outstanding Liabilities Trust Fund—refund	30,807		
Funds previously appropriated for capital expenditure now written back ..	81,964		
	£679,597		£679,597

ORE RESERVE (based on pay limit of 3.4 dwt.) (1954—3.2 dwt.):

As at end of	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch-dwt.
1954	2,544,700	44.34	4.70	208
1955	2,346,700	44.20	4.78	211

During the year the value of the ore mined from the reserve was 4.77 dwt. which is 0.07 dwt. higher than the value of the reserve at the end of 1954.

DEVELOPMENT :—

Advanced	Footage Sampled	Percentage Payable	Average reef width (inches)	Average assay value (dwt.)	Inch-dwt.
23,250	18,475	26.5	18.56	19.40	360

DIVIDENDS.—The distributable profits of the company were enhanced as a result of the sale, during the year, of surplus plant and buildings, which has had the effect of freeing profits previously appropriated for capital expenditure. It was consequently possible to increase the dividend per share to 54d. compared with 24d. for the previous year.

OPERATIONS.—As forecast in the 1954 report and accounts, the company's Nos. 2 and 4 shafts were closed down during the year, and the salvage of all equipment was completed. It is expected that mining operations in the No. 6 shaft area will cease during the current year after the remaining payable sections in the area have been mined. The closing of these shafts should not appreciably affect the tonnage of ore available but should result in a reduction of working costs as operations will now be more concentrated in the south-western section of the company's mining area.

CAPITAL EXPENDITURE.—During 1955 there was a credit to shaft sinking, development and equipment of £70,069 as the result of sales of buildings and material. It is estimated that there will not be any capital expenditure under this heading during the current year.

DAGGAFONTEIN MINES LIMITED

CAPITAL: Authorised—£2,000,000. Issued—£1,750,000 in 7,000,000 Shares of 5s. each, fully paid.

Tons milled 2,658,000. Yield (per ton, 4.57 dwt.) 607,434 oz.

Income and Expenditure Account	£	Appropriation Account	£
Revenue (per ton milled 57/5.7)	7,638,020	Taxation:—	
Working Costs (per ton milled 29/11.6)	3,981,998	Union Government Income Tax	1,991,731
Working Profit (per ton milled 27/6.1)	3,656,022	Provincial Tax	5,195
Uranium and Sulphuric Acid Profit—subject to adjustment	1,682,038	Government's share of Profits under Mining Lease Dividend No. 45 of 2/9 per share	962,500
Total Working Profit	5,338,060	Dividend No. 46 of 3/- per share	1,050,000
Sundry Revenue, less Expenditure	116,756	Directors' Special Remuneration	7,500
Less: Interest on Uranium Loans	161,588	Appropriations for Capital Expenditure:—	
	5,293,228	Expenditure on Fixed Assets	81,511
Add—		Redemption of Uranium Loans	401,514
Unappropriated Profits at 31st December, 1954	450,258	Balance unappropriated at 31st December, 1955 ..	428,815
Silicosis Outstanding Liabilities Trust Fund refund	15,845		
	£5,759,331		£5,759,331

ORE RESERVE (based on pay limit of 2.9 dwt.) (1954—2.9 dwt.):

As at end of	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch-dwt.
1954	13,468,600	43.95	5.47	241
1955	12,768,000	43.58	5.32	232

Included in the Reserve at the end of 1955 were 5,095,600 tons, averaging 6.35 dwt. over a width of 47.04 inches, equivalent to 299 inch-dwt. on the Kimberley Reef Series.

The value of the ore mined from the Reserve in 1955 was 5.57 dwt.

DEVELOPMENT :—

	Footage Advanced	Sampled	Percentage payable	Avg. reef width (inches)	Avg. assay value (dwt.)	Inch- dwt.
Main Reef Leader	19,097	16,975	42.2	19.02	16.12	307
Kimberley Reef	28,415	24,435	26.9	20.37	23.30	475

INVESTMENTS.—The Company's shareholding in East Daggafontein Mines, Limited, remains unchanged at 449,892 shares.

CAPITAL EXPENDITURE.—During 1955 capital expenditure on shaft sinking, development and equipment amounted to £54,997, and capital expenditure on the uranium plant amounted to £24,289, making a total of £79,286.

Capital expenditure for the current year is estimated at £95,000 for gold and £15,000 for uranium.

BRAKPAN MINES LIMITED

CAPITAL: Authorised and Issued—£1,150,000 in 4,600,000 Shares of 5s. each, fully paid.

Tons milled 1,283,000. Yield (per ton, 3.42 dwt.) 219,167 oz.

Income and Expenditure Account	£	Appropriation Account	£
Revenue (per ton milled 42/11.3)	2,754,728	Taxation:—	
Working Costs after transferring £15,850 to working costs reserve (per ton milled 40/2.8)	2,580,810	Union Government Income Tax	3,663
Working Profit (per ton milled 2/8.5)	173,918	Provincial Tax	732
Sundry Revenue less Expenditure	50,708	Government's Share of Profit under Mining Lease Dividends No. 85 of 41d. per share and No. 86 of 71d. per share	14,970
Total Profit	224,626	Directors' Special Remuneration	230,000
Add—		Appropriation for capital expenditure	7,500
Balance to credit of Appropriation Account at 31st December, 1954	363,785	Balance unappropriated at 31st December, 1955 ..	359,522
Silicosis Outstanding Liabilities Trust Fund—refund ..	31,716		
	£620,127		£620,127

ORE RESERVE (based on pay limit of 3.8 dwt.) (1954—3.6 dwt.):

As at end of	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch-dwt.
1954	3,257,100	45.73	4.76	218
1955	2,776,700	46.21	4.79	221

The reserve includes ore developed on the Footwall Reef, which totalled 439,040 tons averaging 6.37 dwt. over a stope width of 72.00 inches. The value of the ore mined from the reserve in 1955 was 5.13 dwt. per ton, being 0.36 dwt. above the average value of the reserve at the beginning of the year.

DEVELOPMENT :—

Footage		Percentage payable	Average reef width (inches)	Average assay value (dwt.)	Inch-dwt.
Advanced	Sampled				
58,532	46,945	27.5	60.87	12.16	740

Development footage on the Footwall horizon was increased with a view to increasing the tonnage available for mining in this zone. The results obtained which are included in the totals and averages above, are as follows:—

26,436	21,930	31.1	92.34	11.34	1,047
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INVESTMENTS.—The Company's holding in The South African Land & Exploration Company, Limited, remains unchanged at 361,067 shares.

GENERAL.—Following the installation of two additional pachuca tanks at the slimes plant, the sands plant was closed and treatment has been on an all-slimes basis since February. This has resulted in reduced operating costs and improved extraction.

WESTERN REEFS EXPLORATION AND DEVELOPMENT COMPANY, LIMITED

CAPITAL: Authorised—£2,000,000: Issued—£1,750,000 in 7,000,000 Shares of 5s. each, fully paid.

Tons milled 1,411,500 Yield (per ton 3.80 dwt.) 268,388.36 oz.

Income and Expenditure Account		Appropriation Account	
	£		£
Revenue (per ton milled 47/9.6)	3,373,747	Taxation:—	
Working Costs (per ton milled 38/9.7)	2,739,094	Union Government Income Tax	423,999
		Provincial Tax	3,519
Working Profit (per ton milled 8/11.9)	634,653	Government's share of profits under mining lease	427,518
Uranium and Sulphuric acid Profit—subject to adjustment	1,627,736	Dividend No. 28 of 1s. 3d. per share	27,993
Total Working Profit	2,262,389	Dividend No. 29 of 1s. 3d. per share	437,500
Sundry Revenue, less Expenditure	58,933	Directors' Special Remuneration	8,000
	2,321,322	Appropriations for Capital Expenditure:—	
Less: Interest on Uranium Loans	194,194	Expenditure on Fixed Assets	172,433
	2,127,128	Redemption of Uranium Loans	482,534
Add: Unappropriated Profit at 31st December, 1954	385,619	Redemption of Unsecured Redeemable Debentures	200,000
Silicosis Outstanding Liabilities Trust Fund—refund	650	Unappropriated Profit—31st December, 1955	319,919
	£2,513,397		£2,513,397

ORE RESERVE (based on pay limit of 3.50 dwt.) (1954—3.30 dwt.):

As at	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch. dwt.
1954	4,479,000	46.58	4.68	219
1955	4,375,900	46.98	5.06	238

Included in the ore reserve is ore on the Vaal Reef horizon totalling 1,010,100 tons, averaging 8.67 dwt. over 39.87 inches equal to 339 inch-dwt. The value of the ore mined from the Reserve during 1955 was 4.75 dwt.

DEVELOPMENT:—

	Footage Advanced	Sampled	Percentage payable	Avg. reef width (inches)	Avg. assay value (dwt.)	Inch. dwt.
Elsburg Reef Series	29,481	17,005	39.5	25.69	17.96	461
Vaal Reef	42,028	13,450	56.1	8.42	59.78	503

In addition, prospecting development was accomplished on a portion of the farms Goedgenoeg No. 62 and Nootgedacht No. 53, which are outside the Mining Lease Area, but over which your Company holds rights under the Reserved Minerals Development Act. The footage advanced in these areas during 1955 totalled 15,506 ft. of which 4,590 ft. were sampled; the payable footage, equivalent to 59.9 per cent amounted to 2,750 ft., averaging 17.03 dwt. over 38.79 inches equal to 461 inch-dwt.

PROPERTY.—The Minister of Mines has recently agreed to recommend the grant of a mining lease over 622 claims on the farm Goedgenoeg No. 62 subject to a relatively small increase in the share of profits payable to the Government. Pending the formal grant of the lease, authority has been obtained to stope, without restriction, within the area concerned. In 1956, there should be further increases in the tonnage milled derived from the Goedgenoeg area and the Vaal Reef horizon. This should assist in meeting the problem of the declining yield from the Elsburg Reef series in other parts of the mine.

The company has sold, since the close of the past financial year, to The New Pioneer Central Rand Gold Mining Company, Limited, for township purposes, the surface rights of a portion of the farm Palmietfontein No. 29, district Klerksdorp, measuring approximately 149.445 morgen at a price of £100 per morgen. The sale is subject to the consent of the Natural Resources Development Council being obtained to the use of the property for township purposes.

ZANDPAN GOLD MINING COMPANY LIMITED.—A company, called Zandpan Gold Mining Company, Limited, has been formed to take possession of the mineral rights over an area of approximately 3,847 morgen lying to the North of the Western Reef and Vaal Reef mining lease areas. The new company will have an initial capital of £400,000, of which £200,000 will be working capital. An amount of £200,000 will be paid in cash to the vendors of the mineral rights. This will be applied in subscribing for shares at par in the new company. Of the amount of £200,000 your company will receive £34,446 in respect of an area of 589 morgen of the farm Palmietfontein No. 29 and will subscribe for shares to this amount. A further amount of £28,183 will be payable in cash to your company in the event of the new company applying for a mining lease and after it has made a further issue of shares.

LOANS.—NATIONAL FINANCE CORPORATION OF SOUTH AFRICA.—On the 31st December, 1955, the company redeemed a further £200,000 of the loan advanced to it by the National Finance Corporation of South Africa against the issue of unsecured redeemable debentures. The balance of £100,000 still outstanding is to be redeemed by not later than the 31st December, 1956.

ORKNEY TOWNSHIP.—The company is the owner of Orkney Township situated on the farm Orkney No. 115, district Klerksdorp. During the year 239 stands were sold for £77,512; 646 stands in the Township are still available for sale. Total collections in respect of sales of stands since the inception of the Township amounted to £182,620 at the end of 1955.

CAPITAL EXPENDITURE.—During 1955 capital expenditure on shaft sinking, development and equipment amounted to £383,830 and capital expenditure on the uranium plant amounted to £37,722, making a grand total of £421,552.

EAST DAGGAFONTEIN MINES, LIMITED

CAPITAL: Authorised—£2,000,000. Issued—£1,865,000 in 3,730,000 Shares of 10s. each fully paid.

Tons milled 1,146,000. Yield (per ton, 3.33 dwt.) 190,931 oz.

Income and Expenditure Account		Appropriation Account	
	£		£
Revenue (per ton milled 41/10.4)	2,399,093	Taxation:—	
Working Costs (per ton milled 32/8.3)	1,873,305	Union Government Income Tax	241,477
		Provincial Tax	682
Working Profit (per ton milled 9/2.1)	525,788	Directors' Special Remuneration	242,159
Sundry Revenue, less Expenditure	11,780	Appropriation for Capital Expenditure	8,000
Total Profit	537,568	Dividends:—	
Add—		No. 31 of 9d. per share	139,875
Balance to credit of Appropriation Account at 31st December, 1954	287,463	No. 32 of 10½d. per share	163,188
Silicosis Outstanding Liabilities Trust Fund refund	4,120	Unappropriated Profit 31st December, 1955	274,976
	£829,151		£829,151

ORE RESERVE (based on pay limit of 3.3 dwt.) (1954—3.3 dwt.):

As at	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch. dwt.
1954	4,091,700	36.77	4.24	156
1955	4,206,300	36.75	4.21	155

The Reserve, at the end of 1955, includes ore developed on the Kimberley Reef which totalled 1,335,800 tons averaging 5.09 dwt. over a stoping width of 36.89 inches equivalent to 188 inch-dwt.

During the year under review the ore mined from the reserve was 4.37 dwt. which is 0.13 dwt. higher than the value of the Reserve at the end of 1954.

DEVELOPMENT:—

	Footage Advanced	Sampled	Percentage payable	Avg. reef width (inches)	Avg. assay value (dwt.)	Inch. dwt.
Main Reef Leader	16,160	12,320	23.3	9.61	24.58	236
Kimberley Reef	24,077	19,250	25.4	6.12	67.74	415

THE SOUTH AFRICAN LAND AND EXPLORATION COMPANY, LIMITED

CAPITAL: Authorised—£500,003. Issued—£433,125 in 2,475,000 Shares of 1s. 6d. each, fully paid.

Tons milled 1,105,000. Yield (per ton, 3.83 dwt.) 211,522 oz.

Income and Expenditure Account		Appropriation Account	
	£		£
Revenue (per ton milled 48/0.9)	2,656,248	Taxation:—	
Working Costs after transferring £4,900 from working costs reserve (per ton milled 36/8.4)	2,027,855	Union Government Income Tax	277,385
		Provincial Tax	1,284
Working Profit (per ton milled 11/4.5)	628,393	Government's Share of Profits under Mining Lease	278,669
Sundry Revenue, less Expenditure	17,070	Dividend No. 34 of 1s. 4½d. per share	8
Total Profit	645,463	Dividend No. 35 of 1s. 6d. per share	170,156
Add—		Directors' Special Remuneration	185,625
Balance to credit of Appropriation Account, 31st December, 1954	277,397	Appropriation for Capital Expenditure	7,639
Silicosis Outstanding Liabilities Trust Fund—refund	2,875	Balance unappropriated at 31st December, 1955	14,865
	£925,735		268,773
			£925,735

ORE RESERVE (based on pay limit of 3.4 dwt.) (1954—3.3 dwt.):

As at	Tons	Stope Width (inches)	Stope Value (dwt.)	Inch. dwt.
1954	3,328,100	42.01	5.23	220
1955	3,679,000	42.82	5.57	239

The value of ore mined from reserve in 1955 averaged 5.22 dwts.

DEVELOPMENT:—

	Footage Advanced	Sampled	Percentage payable	Average reef width (inches)	Average assay value (dwt.)	Inch. dwt.
S2,121	34,210		41.4	22.92	19.68	451

CAPITAL EXPENDITURE.—During 1955 expenditure under this heading on shaft sinking, development and equipment amounted to £17,713. Expenditure for the current year is estimated at £6,450.

VAAL REEFS EXPLORATION AND MINING COMPANY, LIMITED

EXTRACT FROM THE STATEMENT BY THE CHAIRMAN, MR. J. W. SHILLING, WHICH HAS BEEN CIRCULATED WITH THE ANNUAL REPORT AND ACCOUNTS FOR THE YEAR 1955.

By the end of 1955, your company's mine had been brought near to the time when it should commence production.

The sinking of the vertical and subvertical ventilation shafts has been completed, and, by the end of December, 1955, a total of 13,368 ft., out of the programme of 14,800 ft. for the shaft system, had been carried out. It is hoped that the sinking and equipment of the vertical main shaft will be completed by the end of April, 1956. The sinking and equipment of the subvertical main shaft should be completed by the end of July, 1956. During the course of shaft sinking, the world record for a circular shaft, sunk under manual cleaning conditions, was broken in January, 1955 when 590 ft. were sunk in the vertical ventilation shaft. This was eclipsed in the same shaft in March, 1955, when 667 ft. were sunk. Since then the record set up by the mine has been broken by West Rand Consolidated Mines, Limited.

During the year, the 59 level haulage was holed from the No. 3 Joint Shaft system to the No. 1 Shaft system. These shaft systems are, accordingly, now connected underground on the 40 and 59 levels by twin haulages, each about 8,000 ft. in length.

The Vaal reef was intersected, in October, 1955, in the subvertical main shaft at a depth of 5,464 ft. below surface, giving an average value of 91.16 dwt. over a width of 2.94 inches, equivalent to 268 inch-dwt.

Development which is being carried out from the subvertical shaft of the No. 3 Joint Shaft system, has continued most satisfactorily since 1954. At 55,900 ft., the development footage for 1955 was greater than the total footage accomplished in the previous two years. Of the footage sampled 85.5 per cent proved payable, with an average value equivalent to 573 inch-dwt. During the year the uranium values obtained in development continued at a satisfactory level.

It will be of interest to members to know that 110,685 ft. of development had been accomplished by the end of 1955. Of this total 20,091 ft. had been developed on reef—mainly in the vicinity of the No. 3 Joint Shaft system from which the greater part of the stoping ore will be drawn during the initial period of production. Of the development on reef, 19,930 ft. had been sampled giving an average value of 80.37 dwt. per ton over an average width of 6.52 inches, equivalent to 524 inch-dwt. Of the footage sampled, 17,120 ft. or 85.9 per cent

had proved payable, giving an average value of 92.40 dwt. per ton over an average width of 6.45 inches, equivalent to 596 inch-dwt.

Since the end of the year, the gold reduction plant has been completed and test milling started. Steady progress has been made on the construction of the uranium plant which should be completed early in the second quarter of 1956. It is expected that gold and uranium production will commence about the middle of 1956.

In May, 1955, the company made a further issue of 2,700,000 shares of 5s. each at a price of 30s. per share, bringing the total issued share capital to £2,500,000 divided into 10,000,000 shares of 5s. each. The total capital raised to date, less the costs of share issues, is £8,672,971.

Expenditure on shaft sinking, development and equipment during 1955, amounted to £4,475,185 and to £2,163,770 on the uranium plant and buildings. The total expenditure to 31st December, 1955, on these items, together with other items of a capital nature, amounted to £10,482,348, giving as at that date, an excess of capital funds raised (including drawings under the uranium agreements) over expenditure on fixed assets of £374,767.

Earlier estimates of the capital required to bring the mine to gold production have been revised. Considerable additional expenditure has been required on the No. 1 Shaft system, a large part of which is attributable to increased work involved in respect of the subvertical shafts. Moreover, it has been found possible to achieve a higher rate of advance in development than was expected and expenditure under this heading will be considerably more than originally budgeted for. This will, of course, improve the ore reserve position at the date production is commenced. Allowing also for additional expenditure on such items as surface buildings and services equipment, additional European housing, boreholes, etc., it is now estimated that a further amount of about £1,750,000 will be required.

When the company was approved as a uranium producer, loan facilities were arranged through the Atomic Energy Board to the extent of £2,200,500, which, it was then considered, would be sufficient to cover the cost of the uranium plant. Revised estimates now reveal that the cost of the plant will probably be about £2,600,000.

The additional expenditure referred to in the two preceding paragraphs will be financed by means of temporary borrowings—which have been arranged with the Anglo American Corporation of South Africa, Limited—and consideration will be given, in due course, to the question of how the amount should be permanently financed.

NOTES

- 1) **Terms of Employment:** Improvements in pay and certain other benefits were agreed to in November, 1955, in respect of the European employees in the gold mining industry. The basic wages of daily paid employees were adjusted by an increase of 8d. per shift and the consolidation of 10s. per shift of the cost of living allowance with corresponding adjustments for monthly paid employees. These adjustments, which took effect from 1st November, 1955, result in larger pensions benefits and overtime payments. In addition, the holiday leave allowance was increased by £7 10s. 0d. as from 1st July, 1955, bringing it to £35.
- 2) **Price of Gold:** The average price received for gold sold during the year was 250s. 5d. per ounce fine compared with 248s. 9d. during the previous year.

THE FULL REPORTS AND ACCOUNTS CAN BE OBTAINED FROM THE LONDON SECRETARIES OF THE COMPANIES, ANGLO AMERICAN CORPORATION OF SOUTH AFRICA, LIMITED, 11 OLD JEWRY, LONDON, E.C.2.

WINKELHAAK MINES, LIMITED

(Incorporated in the Union of South Africa)

Issued Capital 12,000,000 shares of 10s. each

REPORT OF THE DIRECTORS

Covering the Period from the Inception of the Company to the 31st March, 1956.

SHAFT SINKING.—The collars and the headgears and winders for Nos. 1 and 3 Shafts and for their respective vertical Ventilation Winzes, numbered 1A and 3A, have been completed and sinking in all four is well under way. At the end of the quarter the depths were as follows:—

No. 1 Shaft	92 ft.
No. 1A Ventilation Winze	170 ft.
No. 3 Shaft	203 ft.
No. 3A Ventilation Winze	100 ft.

These four points of entry are expected to intersect the reef horizon at various depths ranging between 750 feet and 1,200 feet. The Ventilation Winzes are situated up dip from their respective shafts, No. 1A being 350 ft. South of No. 1 Shaft and No. 3A 700 ft. South of No. 3 Shaft.

BUILDINGS.—Rapid progress has been made with the initial building programme. Temporary prefabricated buildings to house Europeans have been erected and are in use. Six workshop buildings have been erected of which some are being used as temporary Native accommodation and kitchen. Work on the permanent compound has started. The store building and store offices have been built and occupied.

GENERAL.—Gravel roads have been established to all key points. Electric power is now being supplied by Escom. Erection of the first 40-drill permanent air compressor has been completed. Water for the property is being supplied from boreholes and in addition a substantial dam has been constructed.

EUROPEAN HOUSING.—Four houses have been built in Kinross. Following an inspection of the site, the Townships Board has agreed in principle to the establishment of Evander township and good progress is being made on the erection of the first 138 houses in this township.

EXPENDITURE.—Winkelhaak Mines, Limited.—Expenditure on Shafts, Plant and Equipment and General Expenditure amounted to £434,397.

Evander Township, Limited.—Capital expenditure by this Company, a wholly owned subsidiary, amounted to £66,808.

Stock Exchange Official Year Book 1956

Volume 1 of The Stock Exchange Official Year Book 1956 is now available. This work, together with Volume 2—due to appear next September—is published by Thomas Skinner and Co., Gresham House, London, E.C. The price for the two volumes is £8 net.

It is hardly necessary to reiterate the attributes of this famous reference work which is regarded as indispensable by those who need to obtain speedy access to essential statistical data concerning companies operating in all spheres of business.

A particularly interesting feature which was included for the first time in 1955 has, however, been brought up to date in the 1956 edition. This gives figures in respect of various companies relating to book values, market valuations and distribution of investments.

In addition, readers will be most interested in the revised article on double taxation relief. Price ranges of securities quoted in the Stock Exchange official list are also given.

APPLICATIONS are invited for the post of Chief Mining-cum-Washery Engineer up to April 30, 1956.

Only those who possess the requisite Technical qualifications such as 1st Class Manager's Certificate (Royal School of Mines), Certificates of "Bergassessor," diploma of Engineering, diploma Certificates (Ecole des Mines or equivalent), with some practical mining experience and working of Coal Washing Plants and with first-rate administrative ability need apply. Academic qualifications desirable but not essential. Salary according to qualifications and experience. Terms of Service Contract to be settled at the time of appointment. Knowledge of English essential. 1st Class accommodation provided.

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SURVEYOR required for gold mine in South America. Graduate mining engineer preferred. Must be well experienced in Mine Surveying and Sampling. Knowledge of Spanish an advantage. Salary £107 per month (plus additional two months' pay per year in local currency at the official exchange rate) for two years' contract. Free furnished quarters, etc. Write, giving full details, to Box V. 659, c/o Streets, 110 Old Broad Street, E.C.2.

ASSISTANT MINE SUPERINTENDENT required for gold mine in Latin America. Only graduate mining engineers with many years' experience should apply. Knowledge of Spanish an advantage. Salary up to £2,100 for first year and £2,500 for second year according to experience. Moderate cost of living. Two years' contract. Passage self and wife defrayed by company. Free furnished quarters, etc. Write, giving age and full particulars of training and previous appointments, to Box V. 658, c/o Streets, 110 Old Broad Street, E.C.2.

METALLURGIST possessing University degree and some practical experience required for metallurgical test work in a Gold Milling Plant which includes Base Metal Flotation. Property situated in South America. Salary £107 per month, plus additional two months' pay per year (in local currency at the official exchange rate) for two years' contract. Passage self and wife defrayed by Company. Free furnished quarters, etc. Write, giving age and full particulars training and previous appointments, to Box No. V. 660, c/o Streets, 110 Old Broad Street, E.C.2.

AREA SUPERINTENDENTS required for Sierra Leone Government Mines Department on contract for two tours of 18-24 months in the first instance. Salary scale (including expatriation pay) £859 rising to £1,663 a year. Commencing salary according to qualifications and experience. Gratuity at rate £100/150 a year. Outfit allowance £60. Free passages for officer and wife. Free passages for two children under age 19 or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary. Candidates must possess School Certificate or its equivalent and have had at least two years' experience in the tropics as a development or settlement officer or in a similar type of post. Duties comprise supervision and control of alluvial mining schemes and maintenance of official records and may involve camping in the bush away from easy communication in rough and malarious country. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M3B/42993/MF.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH — GEOLOGISTS

The Civil Service Commissioners invite applications for about six pensionable posts at the Geological Survey and Museum. Age at least 21 and under 30 (31 for permanent members of the Experimental Officer class) on July 1, 1956, with age deduction for regular service in H.M. Forces. Candidates must have obtained (or obtain in Summer 1956) a university degree with first or second class honours in Geology or an equivalent qualification or possess high professional attainments.

Certain of these posts require special qualifications in mineralogy and petrology or in palaeontology. Two posts call for a good knowledge of physics or chemistry. Successful candidates may be required to undertake short-term field investigations on radioactive mineral deposits in various countries overseas.

Annual remuneration (for a 45½ hour week) £554 to £999 (women to £917 but scale being improved under equal pay scheme). Somewhat lower in provinces. Provision for starting pay above minimum. Prospects of promotion. Further particulars and application forms from Civil Service Commission, Scientific Branch, 30 Old Burlington Street, London, W.1, quoting No. S 168/56/10. Completed application forms must be returned by April 26, 1956.

TECHNICAL ASSISTANTS required in London in Contracts Engineering Department dealing with Mine Car Control Equipment for Collieries and Mines. Some previous experience in this class of work an advantage but not essential. Good opportunities owing to expansion of business. Five-day week Pension scheme. Canteen facilities. Write, giving age, experience and qualifications, to the Chief Colliery Engineer, W. B. and S. Co., 82 York Way, King's Cross, London, N.1.

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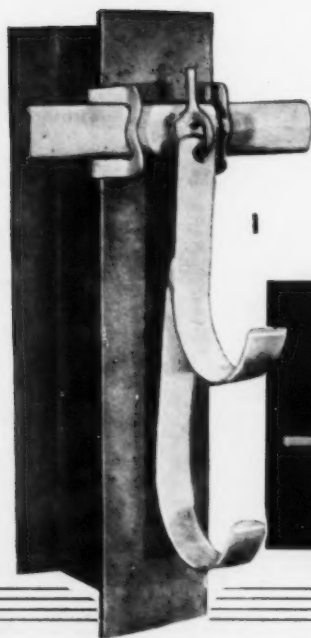
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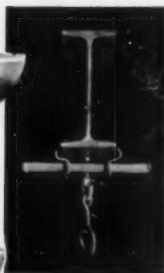
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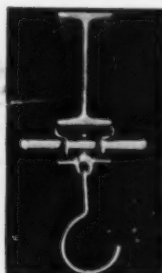
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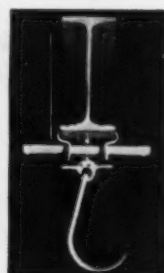
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